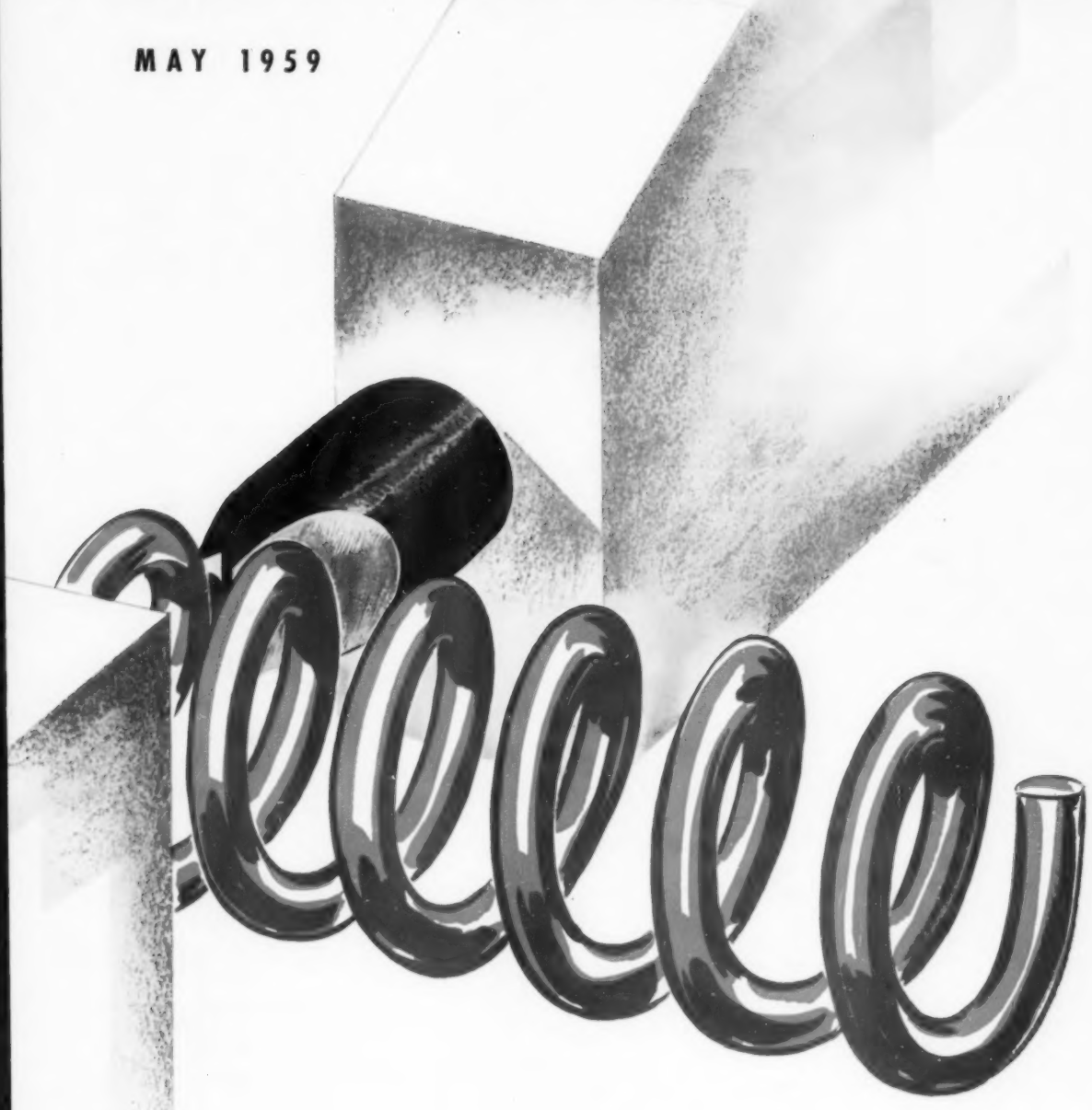
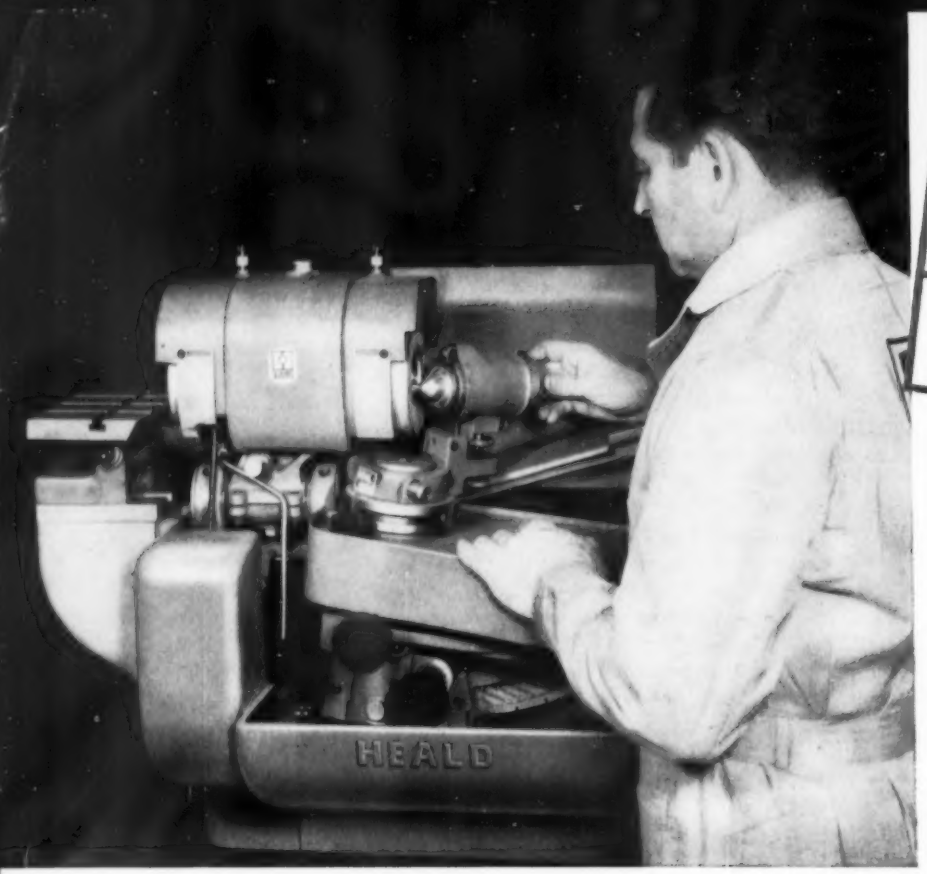
the TOOL ENGINEER

MAY 1959



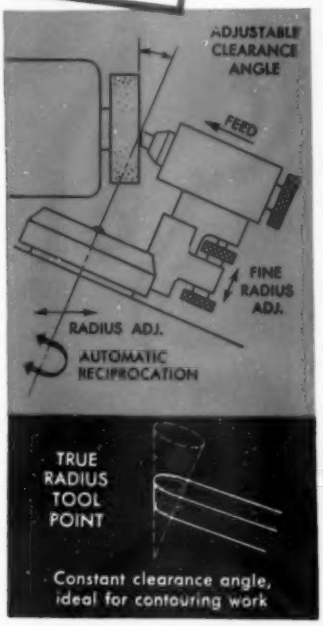
spring forming

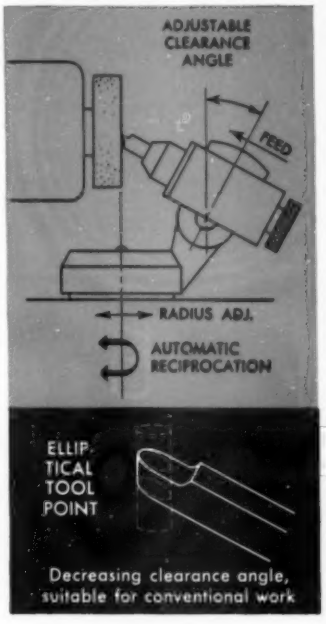
PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



Another **NEW** PRODUCT by Heald

☐ File for Reference
☑ Send for Bulletin





New Model 4 TOOL SHARPENING MACHINE

provides highest precision and economy for both **TRUE RADIUS** and **ELLIPTICAL POINT** tool grinding

SETTING new standards of accuracy and economy, the new Heald Model 4 Tool Sharpening Machine is available for both *true-radius* and conventional *elliptical-point* tool grinding. The True Radius arrangement provides a constant tip radius and constant clearance angle, permitting greater accuracy where the point of contact with the tool varies with the configuration of the workpiece, as in contoured shapes. Where such tool geometry is of no advantage, the Model 3 Tool Sharpening Machine, capable of grinding elliptical point tools only, offers desirable savings in initial cost.

With either model, you get *fully automatic tool reciprocation* providing uniform and repetitive tool tip accuracy which permits one operator to tend several machines at the *same time*. An occasional adjustment of the feed knob (as in photo above) is the only operator attention needed. Offhand grinding attachment at left end of machine is standard equipment, furnished at no extra cost.

Remember — in metal cutting, it's the precision of the *tool tip* that guarantees precision results. Ask your Heald representative for complete information on this new Model 4 Tool Sharpening Machine, or send for Bulletin 2-4-3, Issue 1.

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

the tool engineer

Vol. 42, No. 5 May 1959

Machine Selection—Some Basic Considerations ..... *By Richard F. Thuma* 39
Efficient operation is dependent on wise machine selection. The factors involved are analyzed and case histories are given.

Gadgets 45
Potting fixture . . . milling blind recesses . . . hinged parallel . . . tool post milling fixture . . . boring bar gage.

Spring Manufacture—Control Minimizes Cost ..... *By Sylvester T. Tafelski* 49
To obtain desired performance, all the steps in making springs must be carefully controlled. Process controls cut scrap as well.

Safety Devices Prevent Die Breakdowns ..... *By Federico Strasser* 53
Mechanical overloads can result in die breakage or damage to presses. Protection is assured by simple safety elements.

Cut 75 Percent Faster with Powder Metal Shanks ..... *By Horace A. Frommelt* 55
Tests show that the vibration-dampening characteristics of powder metal shanks minimize tool wear in turning and boring operations.

Calculating Machine Utilization ..... *By Alfred A. Kuebler* 63
Many complex mathematical methods are used to determine optimum machine utilization. A simplified method saves time.

Tooling for Precision Depth Hobbing ..... *By Alex Phillips* 65
Intricate cavities can be produced by pressing a master plug or hob into a block of steel to extrude the desired shape.

Numerically Controlled Drilling—A Case Study ..... *By Josef Wolf* 69
Incorporating an eight-spindle head into a tape-operated drilling machine increased production 700 percent on a part with 3450 holes.

Applications of Retaining Rings ..... *By Hugo Wurzel* 75
Retaining rings simplify assembly and often eliminate certain machining operations. Before-and-after case studies are given.

How to Heat-Treat Small Parts ..... *By Michael Kober* 81
Furnace selection, atmospheres, quenching oils, heating requirements and furnace loading all affect quality of parts.

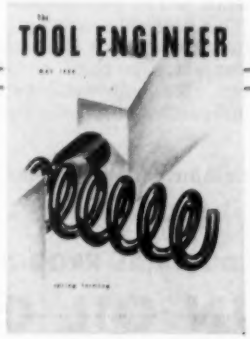
Dividing Circles (Reference Sheet) ..... *By Y. C. Lee* 85
Graphical means are a reasonably accurate method of dividing circles into odd-numbered segments for most drafting purposes.

ASTE NEWS FEATURES 87

President's Editorial 37
Designed for Production 58
Field Notes 139
Good Reading 148
Letter from the Editor 3
Looking Ahead 228
Men at Work 137
Progress in Production 115
Readers' Viewpoints 153
Tech Digests 155
Tool Engineering in Europe 150
Tools at Work 71
Tools of Today (New Products) 117
Trade Literature 145
Who's Meeting and Where 141

THIS MONTH'S COVER

Spring-forming machines, properly tooled, are capable of production at extremely high speeds with excellent accuracy. The forming operation shown here, however, is only one of the many steps that must be controlled in spring manufacture. These steps—heat treating, sizing, finishing and many others—are illustrated in an article starting on page 49.

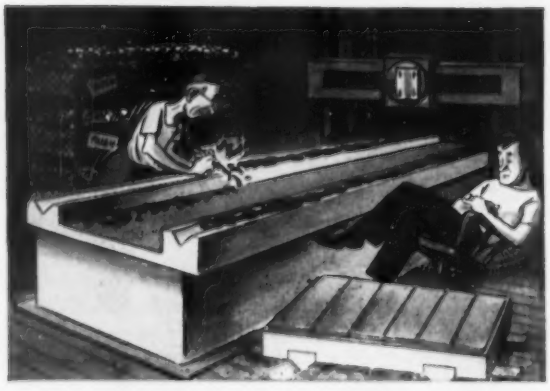


THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index.*

1. Cures "stick-slip" or "jumpy table". When a table gets the "shakes", especially after it has just reversed or when the load is heavy and the speed slow, it's probably suffering from "stick-slip". Remedy—Sunoco Way Lubricant®. Special polar compounds in Sunoco Way Lubricant form a friction-reducing film that keeps a table sliding smoothly under all operating conditions.

2. Doesn't squeeze out. When you use a heavy oil as a way lubricant, you must use a lot of oil to maintain a thick enough film. But, heavy oil squeezes out if the table sits in one position very long. You have a tough time getting the table moving again. Protected by the tenacious thin film formed by Sunoco Way Lubricant, the machine can be idle for a week and it will start easily.

WHY SUNOCO WAY LUBRICANT CAN HELP CURE YOUR MACHINING PROBLEMS



3. Protects expensive ways. Badly scored or pitted ways, caused by inadequate way lubrication, result in lost production and expensive repairs. The high film strength of Sunoco Way Lubricant eliminates the danger of metal-to-metal contact, the chief cause of scoring and way wear. Excellent metal-wetting and non-corrosive properties eliminate rusting and pitting.

For the lubrication of slides and ways on this machine, we recommend the use of
SUNOCO WAY LUBRICANT
a product of
SUN OIL COMPANY

4. Approved by more than 55 machine-tool builders. Every major machine-tool builder has tested Sunoco Way Lubricant. It is always approved. In fact, to assure maximum efficiency of their product, many manufacturers ship a supply of Sunoco Way Lubricant with each machine. We'll be glad to send you the list of manufacturers who have approved Sunoco Way Lubricant.

For more information, see your Sun Representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. TE-5

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

PHILADELPHIA 3, PA.

©SUN OIL CO.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO and MONTREAL

SUNOCO

Harry Conrad
Executive Secretary
Allan Ray Putnam
Publisher

Editorial Staff

John W. Greve
Editor
Theodore W. Black
Senior Associate Editor
Robert W. Reinhardt
Assistant Editor
J. Frederick Parr
Assistant Editor
Dorothy J. Taylor
Assistant Editor
M. L. Stone
News Editor
Elizabeth R. Rooney
Assistant to News Editor
Michael Babala
Art Editor
F. Latitia Durbin
Assistant Art Editor
Virginia Kuczynski
Editorial Assistant

Business Staff

Michael Jakesy
Business Manager
Austin G. Cragg
Advertising Manager
Joann Sapiel
Adv. Production Manager
Marjorie A. Hunt
Circulation Manager

Regional Advertising Managers

Francis Baldwin
New York
Donald N. McElwain
West Hartford
John G. Clarke
New Bedford, Mass.
Richard E. Cleary
Cleveland
Clarence T. Etter
Detroit
Alan Cobleigh
Detroit
Stanley F. Girard
Chicago
Robert E. Ahrensdorf
Los Angeles

Editorial & Business Offices
239 E. Chicago St.
Milwaukee, Wis.

Regional Advertising Offices
Addresses and telephone numbers are listed in "Index of Advertisers" in this issue.

Publication Office
239 E. Chicago St.
Milwaukee, Wis.

THE TOOL ENGINEER is published monthly, except semimonthly in June, in the interest of members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the act of March 3, 1879. Yearly subscriptions: members, $2.00; nonmembers, $6.00; Canada, $6.50, and all other countries, $8.00. Copyright 1959, American Society of Tool Engineers.

No Place for Complacency

Reports show that consumer goods are being produced at increasingly greater rates. Yet the manufacture of capital equipment is still below normal. Apparently, the combination of utilizing the old and of buying new foreign machines has retarded equipment sales.

Many machine tool men say they have priced themselves out of a market. In other words, productivity has not kept pace with wages and inflation. There is however no "corner" on productivity over any extended period. The corner is always gained by improvements in methods and by designing better tools than those used by competition whether domestic or foreign.

It is always refreshing to see new achievements that improve production and make possible better and more goods at a lower cost. Unfortunately, however, inflation has frequently outdistanced advantages with respect to dollar costs. This may be serious where world markets are concerned.

In addition to inflation there is also the danger of complacency. Against this double-edged threat, the tool engineer must be constantly alert. He is a vital part of the team that must counter these destructive forces by intensified efforts.

Speaking of refreshing developments, it is encouraging when the tool engineer wrests a market from countries that have traditionally produced a product as the acknowledged leader—both for quality and price. In one case, neither Japanese nor German optical lens systems can compete with a midwestern manufacturer. This is a perfect example of what can be done constructively. It is industrial teamwork at its best.

John W Greve

EDITOR

This Catalog is a 68 Page Handbook on Drills and Drilling Information

See your Cogsdill Distributor or send the coupon

24 PAGES of Cogsdill's complete drill line

44 PAGES of Engineering data, including drilling of "hot" metals

COGSDILL TWIST DRILL CO., INC.
Greenfield, Mass.

Please send me a copy of your new Cogsdill Drill Catalog and name of nearest Cogsdill Distributor.

Name _____

Position _____

Company _____

Address _____

_____

HARDINGE
ELMIRA, N.Y.

HARDINGE Sjogren Chucks

Quality at Low Cost

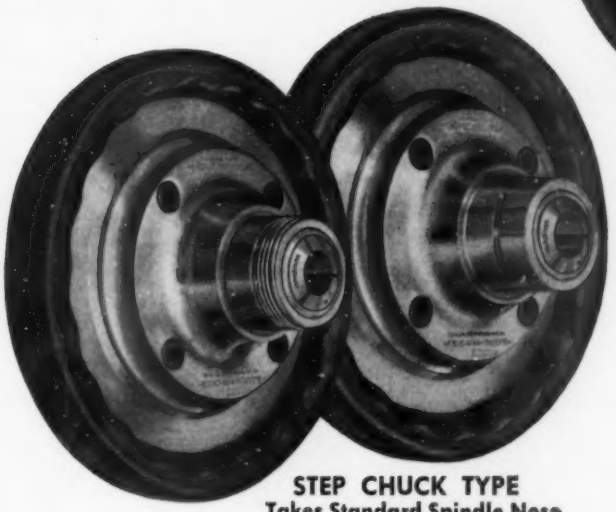
HARDINGE-SJOGREN Speed Collet Chucks for tool room lathes, engine lathes and grinders.

Available for Threaded Nose, Cam Lock, Taper Key Drive and American Standard Spindles.

REGULAR TYPE

AVAILABLE IN FIVE COLLET CAPACITY SIZES

1 1/16", 1 3/8", 1 3/4", 2 1/4", 3 1/2"



STEP CHUCK TYPE
Takes Standard Spindle Nose Accessories As Used With Hardinge Precision Machines

LEVER TYPE

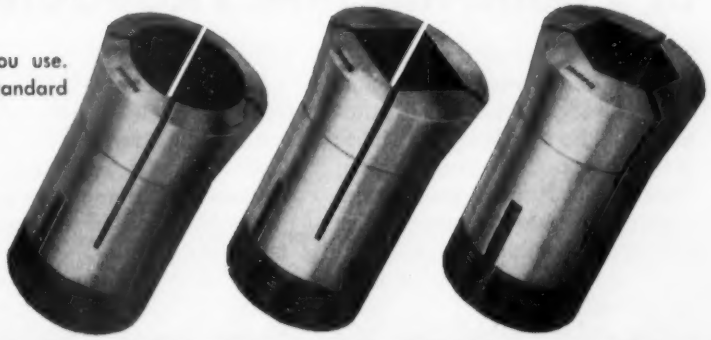
Ask Your Hardinge Representative or Local Distributor For Bulletin 8B

HARDINGE
ELMIRA, N.Y.

HARDINGE Low Cost Steel Collets

Maximum efficiency — Pay for only what you use. Records show that 82% of all sizes used are standard 16th sizes.

Buy only the sizes you use — Hardinge Collet stocks are available in Atlanta, Boston, Hartford, New York, Philadelphia, Rochester, Dayton, Detroit, Chicago, St. Louis, Minneapolis and Los Angeles. Also, Toronto and Montreal, Canada.

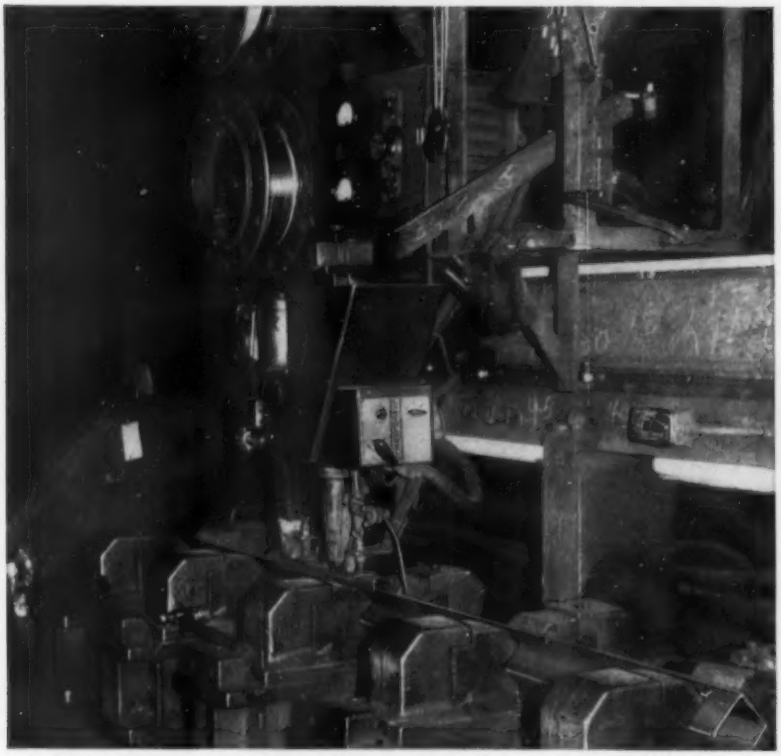


HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.

Lincoln

WELDYNAMICS

NEWS ABOUT ARC WELDING AT WORK CUTTING COSTS



Four foot, ¼" box beam is positioned, welded and cleaned in 2½ minutes. Lincolnweld with Twinarc welds at 90" per minute.

TWINARC SIMPLIFIES WELDING... UPS FARM MACHINE PRODUCTION

The Krause Corporation has increased production on box beams 33% with their Lincolnweld Automatic welder by adding a Twinarc attachment. This company in Hutchinson, Kansas, makes one-way plows, wheel-mounted disc harrows and chisels, self-propelled forage harvesters and other farm equipment.

The Twinarc attachment feeds two welding wires through a single submerged arc welding head, doubling the speed of welding with a single wire.

Krause fabricates the box beams from ¼" angles. The angles are put in a jig, clamped in position with hydraulic positioners. The Twinarc makes one pass on each of the two edge seams at 90 inches-per-minute.

Mr. Wilbur Thomas, Krause's Welding Foreman says, "The Twinarc not only welds faster, but higher currents make it possible to weld the angles without cleaning off light rust and oil which used to cause some imperfections when a single wire was used."

This application has proved so successful at The Krause Corporation that they are now installing their second Lincolnweld Automatic welder with a Twinarc attachment.

For help with welding procedures, or cost reduction ideas, call your Lincoln welding engineer today.

Wilbur Thomas, Welding Foreman, "Savings justified the purchase of a second machine."

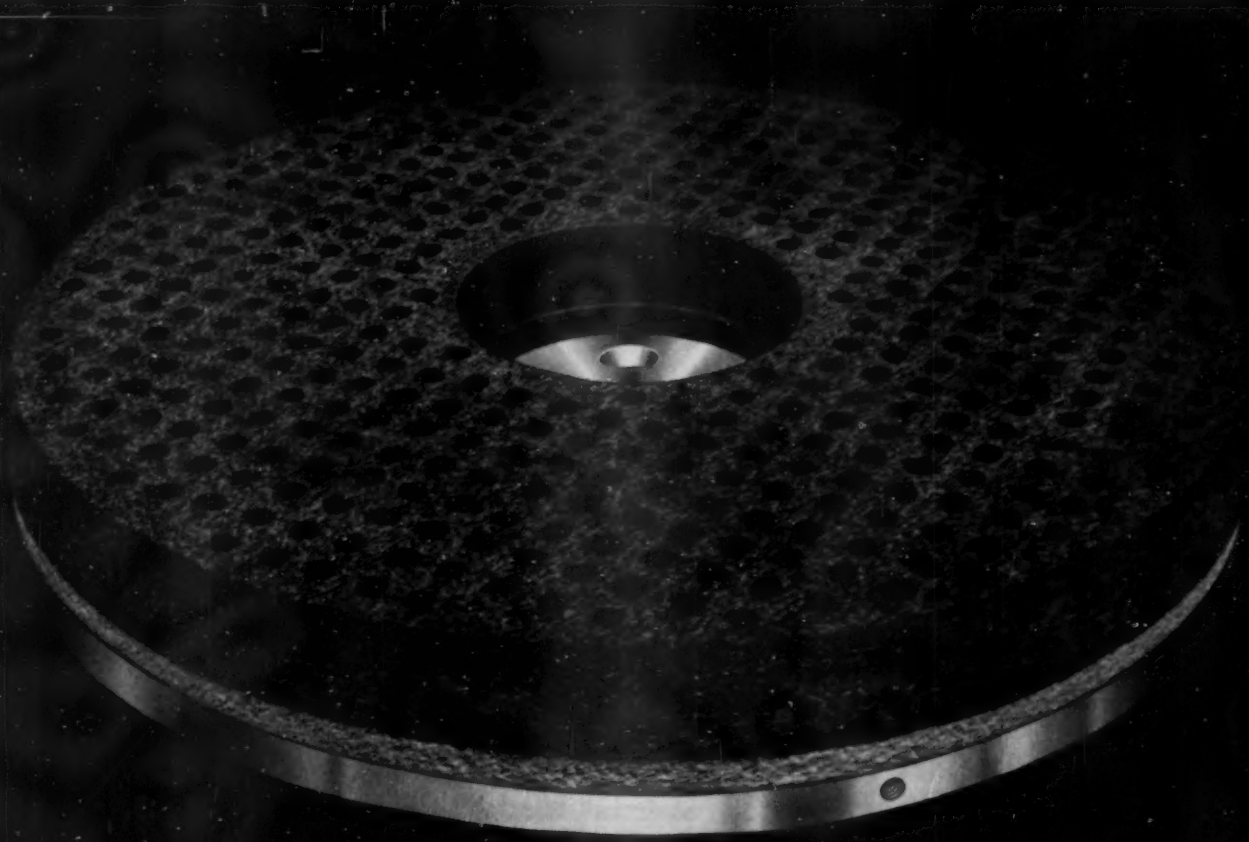
Catalog Available

Complete information on Lincolnweld Automatic Submerged Arc welding equipment and accessories is contained in Bulletin 5200.1. A copy may be obtained by writing, on your letterhead to Lincoln.

THE LINCOLN ELECTRIC COMPANY

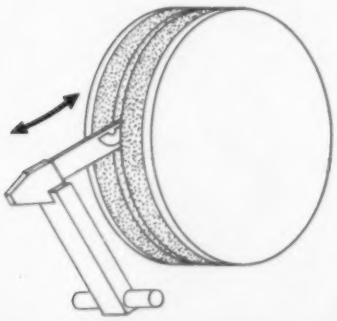
Dept. 5025 • Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment



Gardner disc cuts costs of grinding cast iron cams

...shows highest production per disc in 3-way competition



Production Test	
Disc "A"	5000
Disc "B"	6000
Gardner	7284
Workpiece	Cast Iron Cam
Operation	Grinding both sides of workpiece
Stock Removal	.045"—each side
Flatness	±.0015"
Parallelism	.001"
Uniformity	.001"

GARDNER

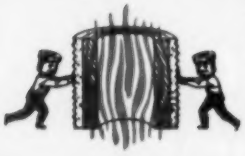
abrasive discs

BELOIT, WISCONSIN

CERAM-A-GRIP American's New ceramic Precision Drill Bushing for PLASTIC TOOLING

CERAMICS — used as a barrier against the tremendously high temperatures encountered by the nose cones on ballistic rockets, has been adapted by the American Drill Bushing Co. to a line of precision drill bushings for use in plastic tooling. The Ceram-A-Grip bushing gives a maximum of protection against bushing misalignment and spin out, with a minimum sacrifice of close hole spacing.

EXCITING new development from the Space Age Laboratories

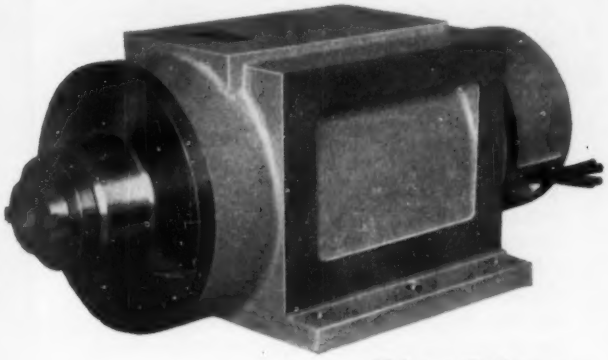


DO YOU HAVE A FRICTIONAL HEAT PROBLEM? THE THIN CERAMIC SHELL PROVIDES AN EFFECTIVE HEAT BARRIER! CERAMIC MATERIAL FUSED TO THE OUTER SURFACE OF THE PRECISION DRILL BUSHING EFFECTIVELY INSULATES THE PLASTIC POTTING MATERIAL FROM ANY EXCESS FRICTIONAL HEAT BUILD-UP IN THE BUSHING.

For High Speed Milling on Non-Ferrous Metals

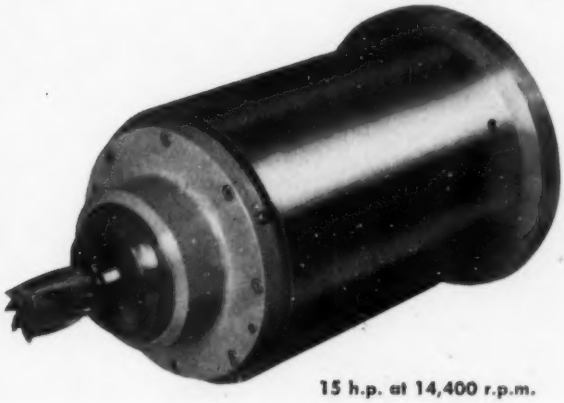
Specify POPE HIGH FREQUENCY HEAVY DUTY PRECISION SPINDLES

These Heavy Duty, High Speed Milling Spindles can be furnished in a wide variety of horsepowers and speeds, ranging from ½ h.p. to 100 h.p. and from 3600 r.p.m. to 60,000 r.p.m. They are unequalled for long life, trouble-free operation and rugged ability to cut metal fast.

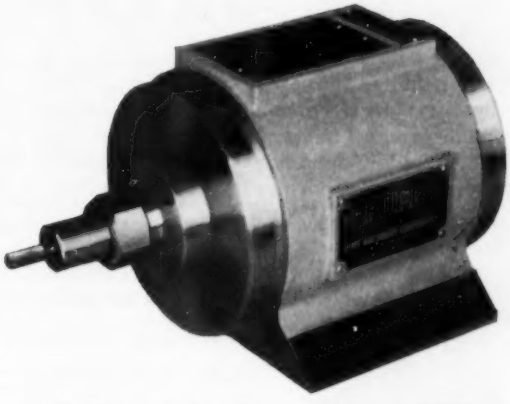


20 h.p. at 7200 r.p.m.
40 h.p. at 14,400 r.p.m.

These Spindles are arranged to operate in horizontal, vertical or angular position, whichever you specify.



15 h.p. at 14,400 r.p.m.



2 pole — 4 pole motor
¾ h.p. at 12000 r.p.m.
½ h.p. at 6000 r.p.m.
1 h.p. at 18000 r.p.m.
1½ h.p. at 36000 r.p.m.

POPE designs and builds *special* High Frequency Spindles for a great range of applications. For recommendations and quotations, let us have your specifications.

No. 97

POPE®

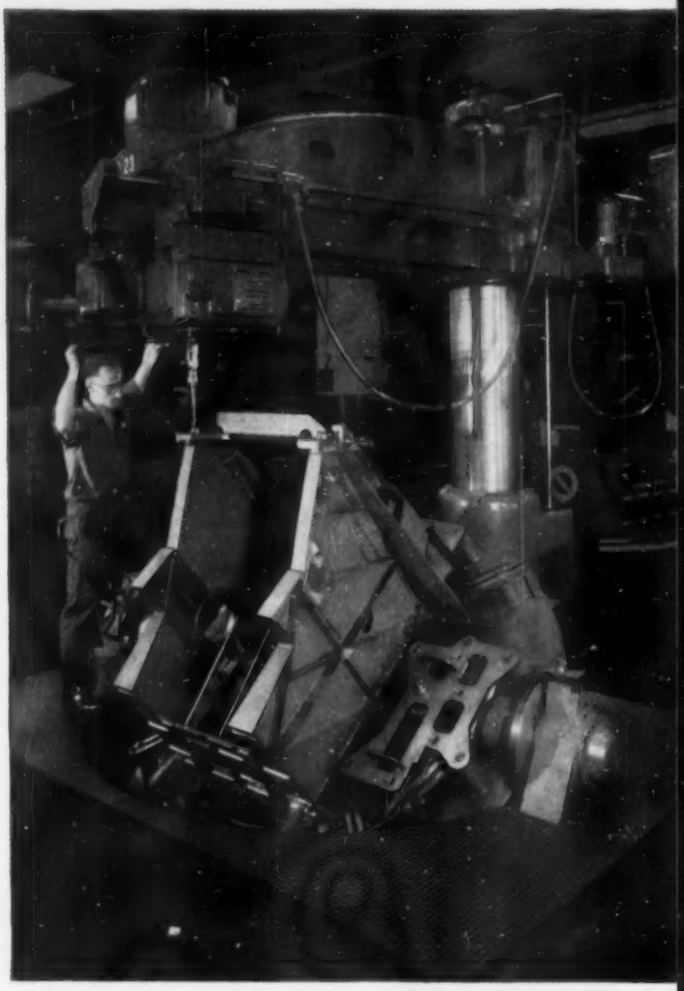
ENGINEERS AND BUILDS STANDARD AND SPECIAL PRECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

Established 1920

A Winning Combination . . .

"American" HOLE WIZARD RADIAL + INGENIOUSLY DESIGNED FIXTURES



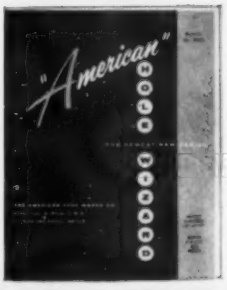
The time on this job was cut to the bone by the combination shown by the illustration. All boring, facing, drilling, tapping and counterboring on the entire job was done in one work setting by means of an ingenious swiveling fixture.

The essential contributor to satisfactorily performing this variety of work is unquestionably the "AMERICAN" Double Lo-Hung Spindle Drive. This is an exclusive "AMERICAN" Hole Wizard feature. It divides the speed range into two separate ranges; the high speeds through a comparatively small gear to minimize gear velocities; the low speeds through a large diameter, wide faced gear to reduce gear tooth pressures to insure minimized wear under severe service.

To further reduce wear and to insure maintenance of original accuracy the spindle and sleeve are made of nitralloy steel nitrided for extreme surface hardness and are mounted on large precision Timken Bearings with convenient outside adjustment which guarantees maximum life, dependable operation and unequalled spindle stability for the life of the machine.

These exclusive "American" features permit your putting your radial drills to work at a profit

There are other advantages too — write for bulletin No. 328.



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

USE READER SERVICE CARD; INDICATE A-5-10

NOW

FOR DRILLING and CHAMFERING PRIOR TO TAPPING

IMMEDIATELY AVAILABLE—

ALL PRACTICAL SIZES—IN 3 STEP LENGTHS 3 SHANK STYLES

with Straight Shank, Tapered Shank or Jobbers Length

Standard SUBLAND DRILLS IN LOCAL STOCKS

Now . . . Mohawk Subland Drills are manufactured in *all* practical *standard* sizes, in 3 step lengths and 3 shank styles—to meet all drilling-chamfering requirements. And, Mohawk Standard Sublands sizes match accepted industry practice on unified thread sizes, hole tolerances, etc.

Why? Because Mohawk Standard Sublands affords a faster, more accurate, economical method of simultaneously drilling and chamfering clean, concentric holes for better tapping operations—plus a saving in tap costs.

Mohawk Standard Subland Drills are available direct from your local distributor's stock—immediately! Start saving production time and equipment dollars today. Call the Mohawk man right now!

Just off the press! This new 12-page Catalog illustrates the multiple advantages of Drilling and Chamfering (prior to tapping) with Mohawk Standard Subland Drills. Lists all practical sizes, types and suggests a simplified method of determining your requirements—more economically. Yours for the Asking!

world's largest producer of Sublands

Mohawk TOOLS, Inc.

MONTPELIER, OHIO

"Far Superior to its Competition"...

. . . states Mr. Creighton Blanchard, toolroom superintendent at New Hampshire Ball Bearings, Inc., Peterborough, New Hampshire

THE NEW, IMPROVED THOMPSON TYPE D HAND FEED

SURFACE GRINDER

Is winning enthusiastic approval wherever precision work is required

Here's what Mr. Blanchard has to say about the new Type D machine:

"We have three grinders in our toolroom—a Thompson and two competing machines. In our general toolroom grinding, especially on carbide and hard metals, we find the Thompson Type D so superior that we have recently purchased another Thompson just like it. All our precision work goes on the Thompson."

Compare these features

- Steel roller anti-friction slides eliminate ball creep and increase rigidity.
- 14" standard vertical capacity under 7" wheel at no extra cost with no loss in vertical capacity when using wet attachment.
- Solid support through entire length of bearing quill assures extra fine finish.
- 5 inch table movement per turn of handwheel improves quality of finish and speeds up operations.
- No backlash, anti-friction ball nuts and screws on cross feed prevent wheel from creeping away from work in shoulder grinding.
- Swing-out stop for table dog contact permits quick movement to wheel dresser.
- Immediate delivery available.

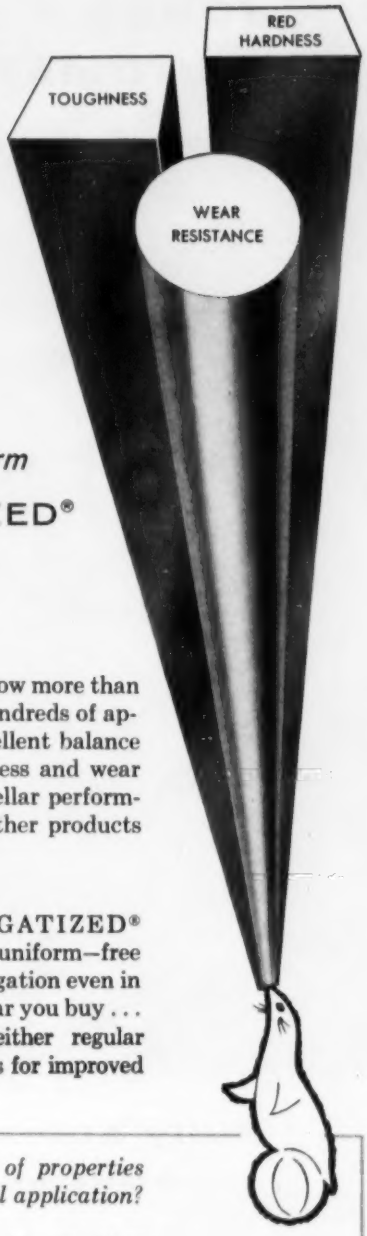
Send for descriptive literature on the new Thompson Type D Grinder.

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

Its balance makes the difference . . .



DOUBLE SIX M-2
HIGH SPEED STEEL

. . . a fully-uniform

DESEGATIZED®

Steel

DOUBLE SIX M-2, now more than ever, is being used for hundreds of applications where its excellent balance of toughness, red hardness and wear resistance pays off in stellar performance of the tools and other products made from it.

Naturally, DESEGATIZED® Double Six M-2 is fully uniform—free of harmful carbide segregation even in the center areas of the bar you buy . . . and it's available in either regular analysis or XL® analysis for improved machinability.

Metalmasters . . .

behind every bar of Latrobe High Speed Steel

- Electrite Double Six M-2*
- Electrite Crusader*
- Electrite Corsair*
- Electrite No. 1*
- Electrite Tatmo*
- Electrite Tatmo V
- Electrite TNW*
- Electrite Dynavan*

**Available in regular analysis or XL® analysis for improved machinability.*

Need better balance of properties for your high speed steel application? Call Latrobe today— ask for Double Six M-2!

Or, send for this booklet . . .

LATROBE STEEL COMPANY

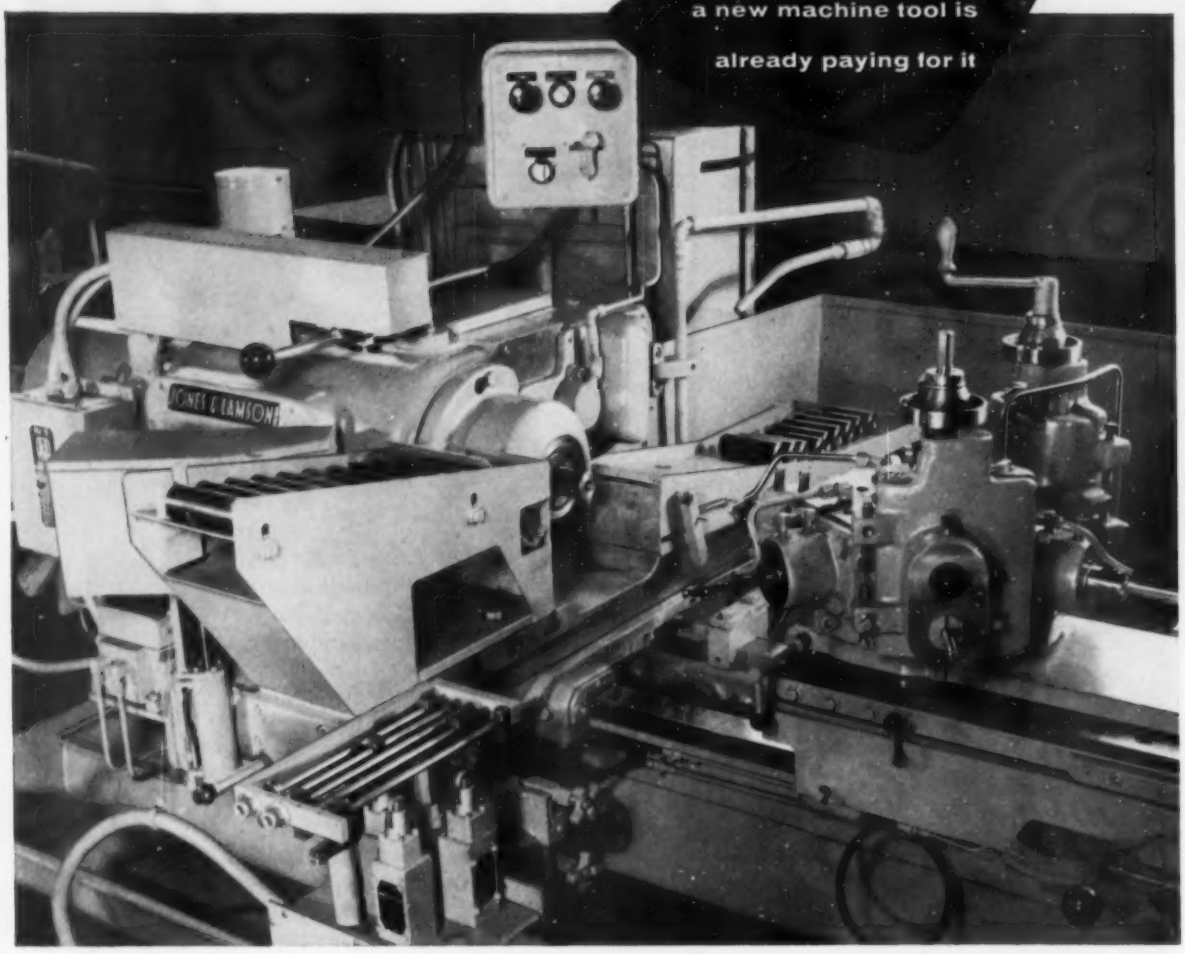
MAIN OFFICE and PLANT: **LATROBE, PENNSYLVANIA**

BRANCH OFFICES and WAREHOUSES:

BOSTON • BUFFALO • CHICAGO • CLEVELAND • DAYTON
DETROIT • HARTFORD • LOS ANGELES • MILWAUKEE
MIAMI • NEW YORK • PHILADELPHIA • PITTSBURGH
SAN LEANDRO • TOLEDO

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it



Fully Automatic Turret Lathe operation reduces machining costs by 32%

This J & L Automatic Ram Type Turret Lathe with Lynn Hydraulic drive provides completely automatic operation from start to stop. A magazine feed for automatic work handling has been mounted on the cross slide. However, on applications where cross slide tooling is necessary, handling devices can be arranged that will free either the front or rear of the cross slide for tooling.

Fourteen similar parts of varying dimensions are produced on this same machine. The tooling used is basically the same as that used in the former, hand-operated method. However, on machining time alone, costs are reduced by 32%. Operator attention for this set-up is only one-third of that previously required. In addition, studies show that one operator can run two or more of these automatics with less fatigue than is involved in running one manual machine. Needless to say, J & L's long-standing reputation for turret lathe accuracy is retained throughout. Write for catalog 5808. Jones & Lamson Machine Company, 518 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

57-75

Here's Why Continental Counterbore Drives

Never Bind! Never Fail!

Continental Counterbores operate precision smooth and detach with a *twist of the wrist* because the driving forces generate *compressing* not *shearing action* in the holder. They never bind, deliver long-lasting, trouble-free operation.

In Continental Counterbores, you get extra torsional rigidity because drive lugs are close to the seating shoulder of the cutter. Double lugs on the cutter engage double abutments in the holder to form a powerful tool. But best testimony to the satisfaction you get from these counterbores is this: *no one has ever reported failure of a Continental Counterbore Drive!* For more information, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit. Available individually or in a choice of three sets.

CTW Continental TOOL WORKS

DIVISION OF

EX-CELL-O CORPORATION, DETROIT 32, MICHIGAN

USE READER SERVICE CARD; INDICATE A-5-15

SPRING STRESSES that formerly required premium-priced materials can now be handled by Duraflex,® which costs no more than regular phosphor bronze. Write for literature and samples, today.

Licensed Professional Engineers, Members American Society for Testing Materials, American Society of Mechanical Engineers, National Society of Professional Engineers

THE CARLSON COMPANY
Consulting Engineers — Machine Designers

3487 WEIDNER AVE.
OCEANSIDE, L. I., N. Y.
TELEPHONE: RO 4-8181

Complete engineering and manufacturing service including design and development of special machinery, mechanical products and spring actuated mechanisms. Stress analysis, spring design, metallurgical data, heat treatment, plant layout, engineering reports, selection of materials and equipment. Tools and products.

August 1, 1958

The American Brass Company
414 Meadow Street
Waterbury, Connecticut

Gentlemen,

SUMMARY OF ENGINEERING LABORATORY REPORT No. 8158

SUBJECT: Fatigue Life and Endurance Limit testing of, "DURAFLEX" Superfine-Grain Phosphor Bronze and Commercial Quality Phosphor Bronze, 5% (A) spring quality strip material.

SPRINGS: Flat spring strip was made into the usual type of contact springs used in switches, relays and instruments. These springs were deflected at about 1 cycle per second in a specially built fatigue testing machine and the deflections recorded.

STRESSES: The springs were deflected from the initial free position of zero stress to a final position having a bending stress of 77,000 p.s.i.

This stress, for phosphor bronze strip is unusually high and is higher than stresses ordinarily recommended for Beryllium-Copper or Stainless Steel for such severe service.

RESULTS: Commercial Quality Phosphor Bronze, 5% (A) springs acquired a permanent set quite early and broke at an average number of deflections of 453,374.

"DURAFLEX" springs were still satisfactory, showed no permanent set, no loss of load and no breakage at 4,000,000 deflections.

CONCLUSION: Design stresses for "DURAFLEX" can be at least 50% higher than the stresses for Commercial Quality Phosphor Bronze, 5% (A) as shown in the TOOL ENGINEERS HANDBOOK.

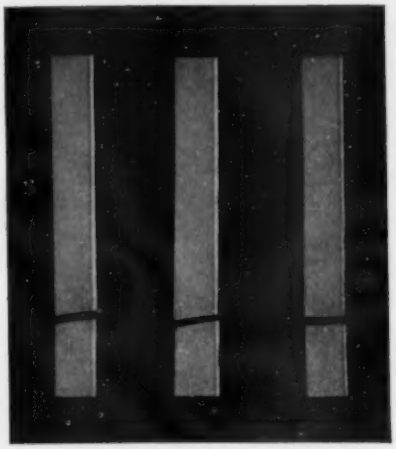
Respectfully submitted,

THE CARLSON COMPANY

Harold Carlson

Harold C. H. Carlson, P.E.
Licensed Professional Engineer

HC:R



THREE SPRINGS of regular Phosphor Bronze, 5% (A), actual size, took a permanent set at about 200,000 deflections and fractured at an average of 453,374 deflections.

FOUR SPRINGS of Duraflex Superfine-Grain Phosphor Bronze, 5% (A) were still satisfactory after 4,000,000 deflections.

DURAFLEX, available in Phosphor Bronzes (A), (C) and (D), in strip and wire, offers a host of opportunities to cut costs while maintaining or improving quality and performance. For further information and technical help to select the alloy to meet your needs—call in your American Brass Company representative, or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

DURAFLEX
SUPERFINE-GRAIN PHOSPHOR BRONZE
A product of
ANACONDA®
Made by The American Brass Company

USE READER SERVICE CARD; INDICATE A-5-17

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS— to help you

NEW HS BALANCER SAVES, UPS ACCURACY FOR BARBER-COLMAN

Simplifies balancing of small high-speed, lightweight work

This setup at Barber-Colman Company, Rockford, Illinois, will show you how to cut balancing costs and improve accuracy on miniature high-speed work.

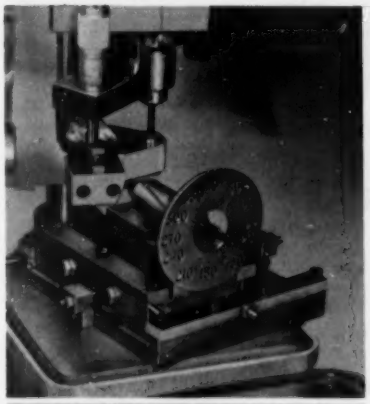
The workpiece, an aircraft control motor armature assembly, weighs 2¼ oz., operates at 13,600 r.p.m. Bearing movements must not exceed 0.000050". Unbalance is corrected by drilling at the 0.245" O.D. radius, in two transverse planes only ½" apart.

All requirements are easily met on a new Gisholt HS-1 Balancer. Work is placed in a special fixture and is driven by a rubber belt on the O.D. The operator notes the angle and amount of unbalance in both correction planes. Next, he places the work in a correction drilling fixture. To correct in each plane, he adjusts a micrometer stop to the depth indicated by the amount meter. The part is oriented angularly by reference to a 360° protractor, and correction is made. A suction device removes all chips. Since drilling is permitted only in the lands, correction cannot be made at the exact angle in all cases and a second run may be required. Up to 15 parts per hour are measured, corrected and inspected for balance with this setup.

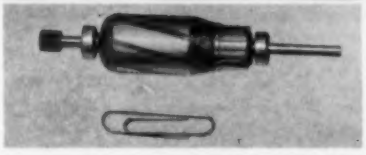
A complete line of high-speed (HS) bench-type balancers (horizontal and vertical models) is available for workpieces from ½ to 8 oz. or from 8 oz. to 10 lb. Belt-, air- or electrically self-driven parts or assemblies containing high-speed rotating parts such as miniature armatures, aircraft and missile gyros, small spindles, turbines, etc., are easily handled. Unbalance causing work support movements greater than .000002" can be accurately measured and located with the work rotating at any speed between 1000 and 3000 r.p.m. or between 4000 and 12,000 r.p.m.

As on all Gisholt Balancers, operation is simple and does not require skilled personnel. Regardless of workpiece weight or method of drive, unbalance can be accurately measured and located in two transverse planes, as little as ¼" apart, with unbalance indications in one plane completely unaffected by unbalance in the other. Accuracy is not affected by extraneous vibrations or electromagnetic disturbances, including those set up by electrically self-driven assemblies.

For more information on the NEW Gisholt HS Balancing Machines, contact your Gisholt Representative or write for literature —Form No. 1207.



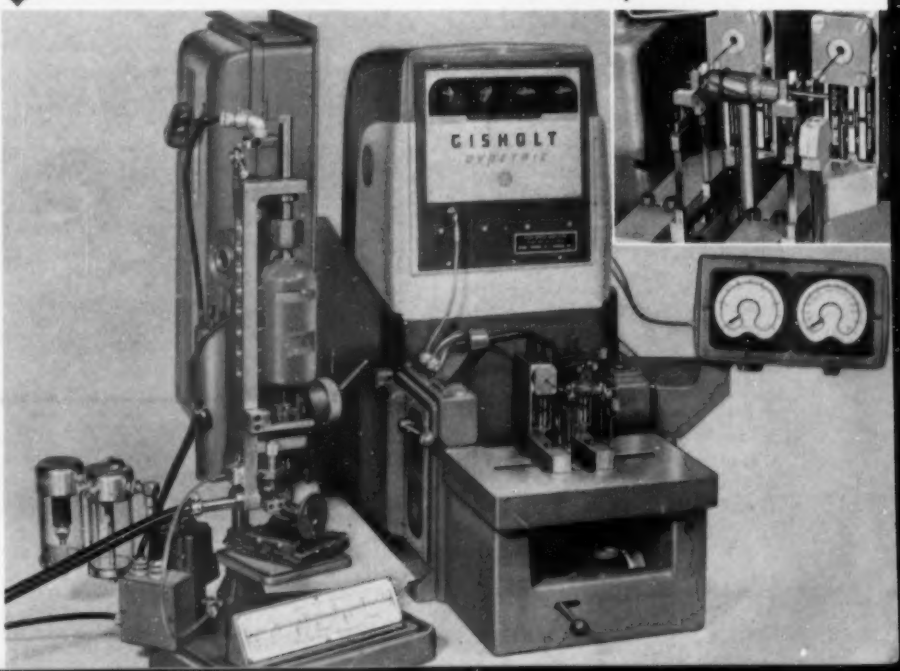
Correction drilling fixture built by Gisholt to meet accuracy requirements of work. Micrometer stop adjusts to indicated drill depth; 360° protractor speeds angular orientation.



Close-up of armature assembly, weighing 2¼ oz., compared to standard paper clip.

Close-up of armature assembly in special fixture that permits balancing on its own bearings. Note photocell at right, triggered by angular reference mark on work, used to energize angle meter.

Accessory equipment for this setup includes a separate direct-reading angle meter and correction drilling equipment. Corrections may be made in two transverse planes, as little as ¼" apart, to full machine accuracy.



HOW MACHINE SPECIALTIES CUTS COSTS ON JOB-LOTS

JETracer and automatic drive team up to speed machining

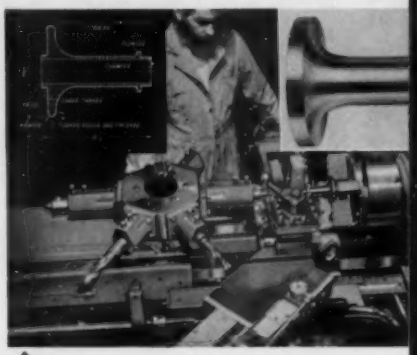
Doing job-lot work requiring close estimates and minimum equipment investment? Then you'll want to study this setup at Machine Specialties, Chicago, Illinois. It saves time and improves accuracy and finish on steel outer flange support castings.

Two MASTERLINE No. 5 Ram Type Turret Lathes are used. Both machines have automatic drives to provide automatic chucking turret lathe efficiency. One has a JETracer, mounted on the rear of the cross slide, to simplify machining of the O.D. contours.

The parts are machined in 100-piece lots in three operations. The first operation setup is shown. Work is held in an air-operated fixture, chucking on the rough flange O.D. Hex turret tools, controlled by the automatic drive, center-drill, drill halfway through and chamfer the bore. Automatic cycle holds while a form tool on the front of the cross slide forms a radius, and the JETracer is used to generate the O.D. contour and face the end. Time, just 7.0 minutes f.t.f.

The other end is machined and the bore is finished on the second automatic drive-controlled No. 5 in only 7.0 minutes, f.t.f. Then the parts go back to the JETracer-equipped lathe where the O.D. contour is finish-traced, to a 125 micro-inch RMS finish, and the radius is finish formed from the front of the cross slide, in only 2.5 minutes, f.t.f.

Automatic drive permits more accurate cost estimates, eliminates chance of human error, provides consistent quality and maximum tool life. JETracer simplifies O.D. contour machining. Operator handles two machines boosting production, cutting costs.



Automatic drive controlled No. 5 ram with JETracer on rear of cross slide. Automatic cycle performs standard machining from hex turret. Cross slide used separately to plunge form from front and trace from rear.

PRODUCTION INCREASED 400% WITH CENTER-DRIVE SUPERFINISHER

Special Superfinisher cuts handling time and saves floor space

Here is another case where a Gisholt Superfinisher not only takes a substantial bite out of production costs, but improves accuracy and concentricity as well.

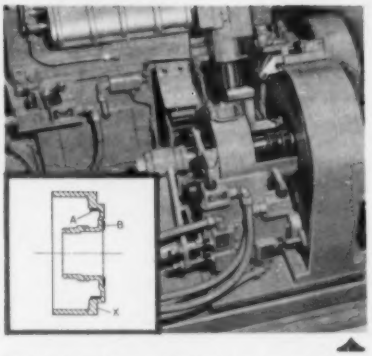
The job: producing a controlled finish in the piston bore and on the opposite thrust face of cast iron transmission clutch piston cylinders. Normally, to meet production requirements, four manually operated machines would be used. Here a special center-drive Superfinisher handles both surfaces simultaneously in one fast, automatic cycle.

Basically the machine is a standard Gisholt Model 51-A General-Purpose Superfinisher. A hollow, center-drive spindle, with a holding fixture, is mounted at the center of the bed casting. The workpieces are "banked" in a loading chute. They roll by gravity into clamping position. A loader at the spindle left, "pushes" the work into the center-drive fixture, locating against face X. Sufficient pressure is maintained to clamp the work during Superfinishing.

A stone-carrying quill above the loader moves down, over into the bore, then up, to Superfinish diameter A (from 125-300 to 15 micro-inches RMS, removing .001″ of stock or less). At the same time a cup-stone on a separate motor driven rotating quill at the spindle right, Superfinishes thrust face B (from 200-300 to 15 micro-inches RMS, removing from .002″ to .003″ stock).

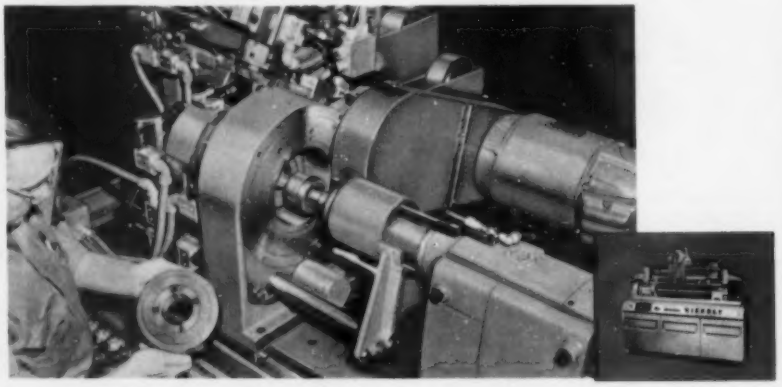
At cycle end, the loader retracts, tripping an ejector causing the work to fall into an unloading chute. The chute tips, rolling the finished part onto an outgoing conveyor. Time, from parts bank to outgoing conveyor, just 21 seconds.

Special Gisholt 51-A Center-Drive Superfinisher completes critical piston bore diameter and opposite thrust face in one chucking—improving quality, concentricity and cutting handling time 75%.



Critical surfaces on both sides Superfinished in one operation. Here stone-carrying quill about to engage piston bore diameter. (Stone life—400 to 450 pieces.) INSET—workpiece showing surfaces handled.

Cup-stone Superfinishes thrust face. (Wheel life of 200 to 250 pieces.) Note load and discharge chutes at upper right and rear.



HOW A. O. SMITH CORP. CUTS REJECTS ON MOTOR FRAMES

Auxiliary slides on No. 12 permits machining both ends simultaneously for greater accuracy

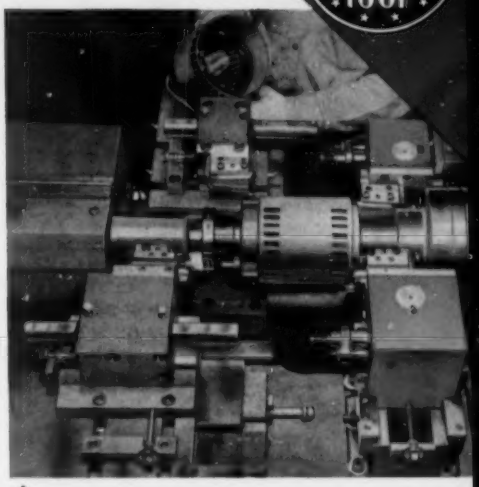
This setup used by A. O. Smith Corporation, Tipp City, Ohio, is worth remembering. It has taken over the work of two older automatic lathes. Smart tooling permits simultaneous machining of rabbet fits at both ends of electric motor frame stator and core assemblies—with the coils in place.

The machine: a versatile Gisholt MASTERLINE No. 12 Automatic Chucking Lathe. Special tooling: tailstock with supporting arbor; shields to keep chips out of the windings; expanding mandrel and bushings to support the work; front and rear auxiliary slides.

Here's how a typical assembly (6½" long, 6" diameter, 3½" bore) is handled: First, chip shields are inserted at both ends. The assembly is placed on the supporting arbor and the tailstock is used to press one shield against a retractable locator at the spindle end of the arbor. An expanding mandrel chucks in the I.D. Tools on the rear independent slide rough-bore the rabbet fit, rough-face and chamfer the I.D. at the tailstock end. Forward feed of this slide actuates the rear auxiliary slide to rough corresponding surfaces at the headstock end. In the same manner, tools on the front carriage and front auxiliary slide finish-bore the rabbet fits and chamfer the O.D. F.t.f. time, a fast 1.0 minute.

Over seven different sizes are handled. The most extensive change-over requires less than one hour.

Machining both ends simultaneously speeds production, eliminates extra handling, improves accuracy. Out-of-round held within .005" total indicator reading, runout within .004" to .006" on parts up to 10" length, up to 6¼" bore.



Overhead view of tooling and work. Note pusher bars on rear independent slide and front carriage, used to operate auxiliary slides and permit simultaneous machining at both ends.

5L CUTS COSTS ON 900-LB. CHUCK BODY FORGINGS

Remote controls, compound cross slide and power chucking save time

If you're machining parts like this 900-lb., SAE 1035 steel 24" chuck body forging, you know it takes power, rigidity and versatility to handle the job at lowest cost.

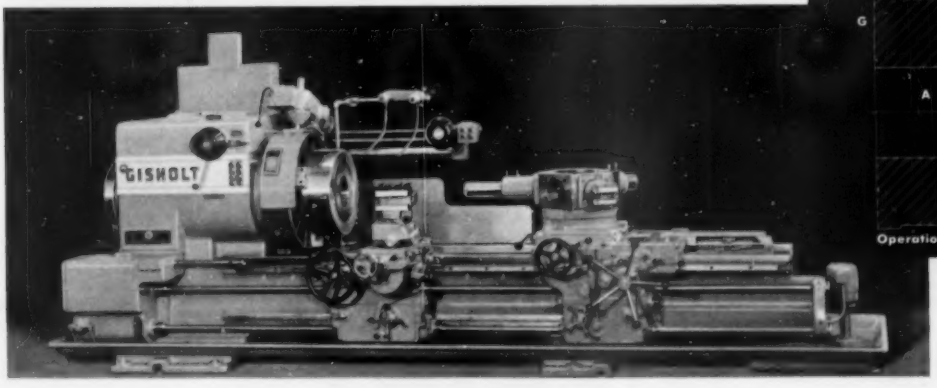
Here's how features and accessories of the Gisholt MASTERLINE 5L Saddle Type Turret Lathe make light work of this heavy job. A compound cross slide with power angular feed simplifies taper boring. A cross-feeding hex turret permits use of standard, low-cost tools for cross-facing, boring various diameters, etc. A second speed selector and remote control save steps and allow the operator to observe the work at all times while changing spindle speeds, starting, stopping, reversing and inching the spindle. Fine finish is assured through a 24-speed headstock, offering a wide choice of speeds in a range from 6 to 340 r.p.m. with maximum metal removal obtained by a 75 h.p. motor. A power hoist supports the work for chucking in a 32", 3-jaw scroll chuck.

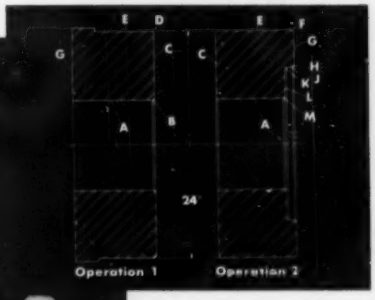
Here's the first operation: hex turret tools bore A and face C, while square turret tools turn E and chamfer B-D. Total f.t.f. time, 30.6 minutes. This includes 4.5 minutes used to chuck, operate and unload.

For the second operation, change-over is fast and requires only minor tool replacements, stop adjustments and new chuck jaw inserts. Work is held on the previously machined O.D. Hex turret tools face G-L and bore A-K. Compound square turret tools finish-turn E, taper the co-bore J and chamfer F-H-M. Time f.t.f, 43.4 minutes, including 11.2 minutes to chuck, operate and unload.

Power, rigidity of 31,000-lb. 5L, and proper accessories cut costs, simplify and speed machining of heavy-duty work. Second speed selector and remote spindle control save steps, permit full attention to work.

Simple setup on 5L completes 900-lb., 24" chuck body forging in two operations. Note second speed selector and remote control at operator work station. Drawings show surfaces machined in each operation.





MACHINES WITH NEW MACHINE GUARANTEE

MASTERLINE
GISHOLT SINCE 1887

HOW LONG MFG. DIVISION CUTS TIME 30% ON CLUTCH PRESSURE PLATES

Versatile Simplimatic replaces two lathes and one grinder

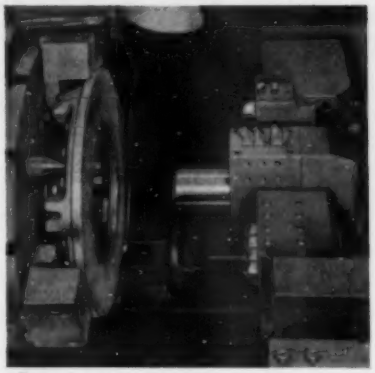
Here is a prime example of how you can cut costs, improve accuracy and quality, by combining operations on modern production equipment.

Formerly Long Manufacturing Division, Borg-Warner Corporation, Detroit, Michigan, used two semi-automatic lathes and one grinder to handle four sizes of cast iron clutch pressure plates, supplied to truck manufacturers. Now these parts are completed in one chucking on a Gisholt Simplimatic Automatic Chucking Lathe. The part shown, 16¾" in diameter, 2⅜" wide, is held in a 21", 3-jaw, air-operated chuck. Three independent tool slides are used. The wide platen table simplifies slide location, eliminates "cutting air" and provides ample support with minimum tool overhang during machining.

During the automatic cycle the platen table feeds forward, plunging four facing tools, on the front slide, to depth. Then standard slide movement feeds the four facing tools out from center, roughing the 3¾"-wide face in one-fourth the time that would be required if a single cutter were used. At the same time the center slide feeds forward with piloted tools that rough- and finish-bore and chamfer the I.D. The rear slide operates separately and carries a single tool used to finish-face the part, feeding from the O.D. to the I.D. F.t.f. time, just 3.02 minutes.

Simple setup replaces two semi-automatic lathes and one grinder, cuts handling and machining time over 30%. Rigid tooling on platen table improves accuracy, provides desired surface finish and flatness formerly obtained by grinding.

Clutch pressure plate (produced in lots of 1000) before and after machining. Rigid tooling provides flatness and 120-160 micro-inch RMS finish on the clutch face, formerly obtained by grinding.



Clutch pressure plate casting, showing method of chucking, locating and tooling used to complete part in one automatic cycle.

JETRACER CUTS TIME 25% FOR RIVETT LATHE & GRINDER, INC.

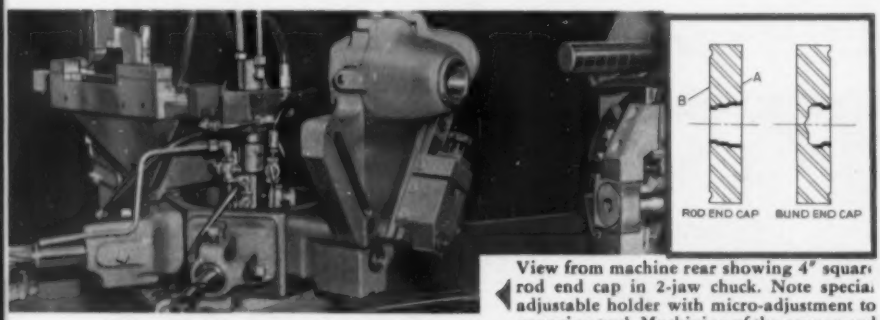
Turret-mounted JETracer slide tool on Fastermatic simplifies job, improves quality

Want to improve accuracy and finish, and speed machining on those tough multi-diameter jobs? Here's a fresh approach used by Rivett Lathe and Grinder, Inc., at its Emery Road plant, Allston, Massachusetts. Setup includes a JETracer slide tool mounted on the turret of a Gisholt 1F MASTERLINE Fastermatic Automatic Chucking Turret Lathe.

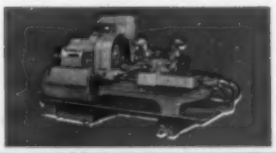
The workpieces are end covers for tie rod air cylinders. They are made from steel blanks ranging in size from 2" square x 1½" thick to 12¾" x 2¼" thick. Ten sizes of each are handled in lots ranging from 200 to 500 pieces. Due to the increased flexibility offered by the JETracer slide tool, all work is handled from the hexagon turret. Eliminating the need for front and rear cross-slide carriage saves additional cost.

All parts are held in an 18", 2-jaw air-operated chuck. The typical rod end cap shown, 4" square x 1¾" thick, is completely machined in just 3.15 minutes f.t.f. time. Work is drilled through and a multi-diameter cutter rough-forms the bore from side A. The cycle stops and the part is reversed. The JETracer generates all bore surfaces shown in black, from side B. The bushing fit diameter is reamed and special holders with micro-tool adjustment rough- and finish-groove the face. The same size blind end cap is machined in a similar manner in 2.45 minutes f.t.f. The surfaces shown in black are traced.

Bore diameters held within .0006" and 65 micro-inch RMS finish requirement easily met with JETracer, and rigid Fastermatic tooling. Tracing cuts time 25%, keeps tooling costs at a minimum.



View from machine rear showing 4" square rod end cap in 2-jaw chuck. Note special adjustable holder with micro-adjustment to grooving tool. Machining of the groove and various bore diameters in one chucking assures concentricity and squareness.



The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

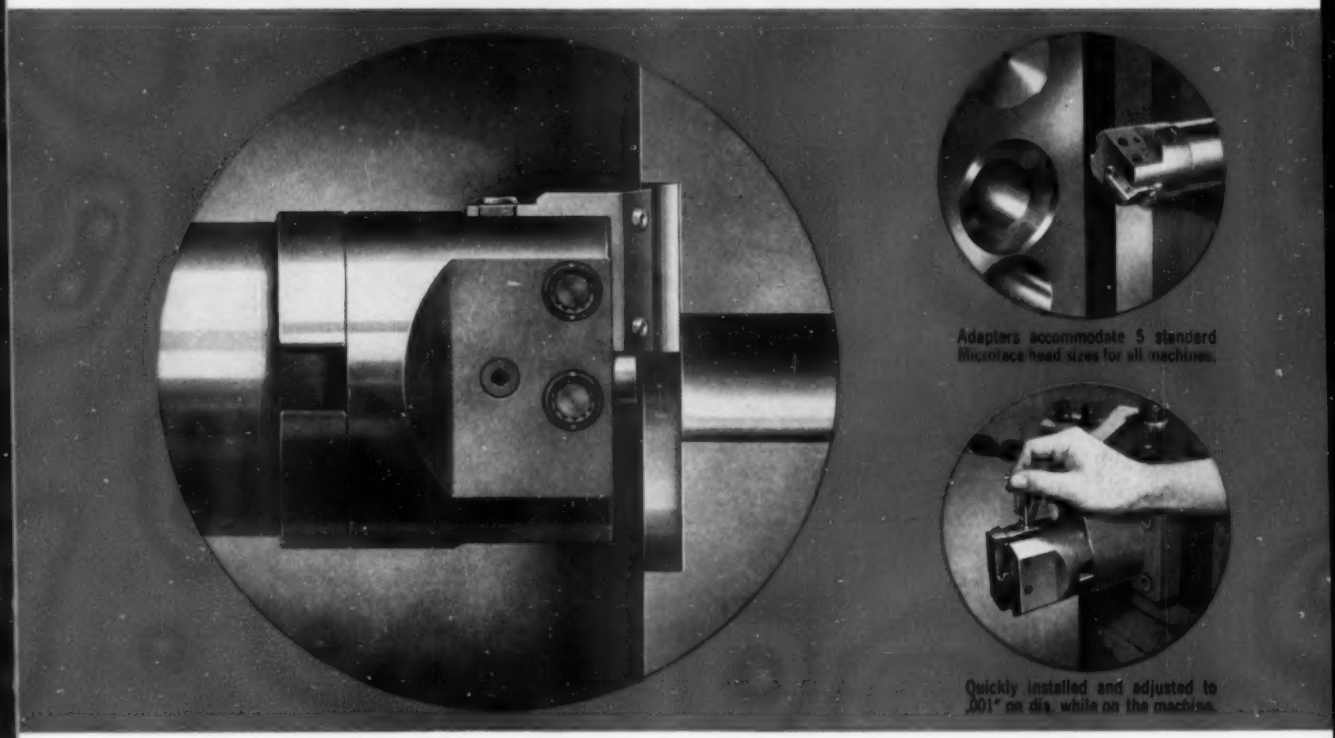
Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Machines • Packaging Machines • Masterglas Molded Plastic Products

NEW FROM **FAIR STREET** • HOME OF MICROBORE

microface®

ADJUSTABLE BLADE FACING HEAD

(Patent Pending)



Adapters accommodate 5 standard Microface head sizes for all machines.

Quickly installed and adjusted to .001" on dia. while on the machine.

For boring machines, turret lathes and heavy drilling equipment, this new addition to the Microbore Tooling System bores, faces or spot faces wide surfaces from 1½" to 8½" dia. without special tooling. Often eliminates the necessity of generating faces by slow cross feed methods. Dovetail blade holder mounting in the rugged, one-piece head eliminates chatter, assures consistent accuracy, fine surface finish and prolongs blade life. Adjustment of interchangeable high-speed steel or carbide blades is fast and accurate. *Blades replaceable with a minimum of down time without removing head from the machine.*

Write for technical 4-page brochure.

DEVLIEG® MICROBORE® SYSTEM

DE-VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

Fair Street, Royal Oak, Michigan

USE READER SERVICE CARD; INDICATE A-5-21

Why the Die Maker Prefers PRODUCTO Die Sets

Volkert Stampings, Inc.

The die maker likes to work with Producto Die Sets

He knows Producto die sets are easy to assemble —especially those equipped with the unique new Qwik-Fit Guide Pins*.

He has confidence in the consistent accuracy of Producto sets. He has found that they always align his dies correctly.

He knows he can choose from a variety of thicknesses the Producto die set that meets the strength requirements of his die.

He favors Producto die sets because they are dependable. They will perform on the press as well as they did in tryout.

He likes the attractive, streamlined appearance of Producto sets. They make his dies look better and increase his pride in these products of his craftsmanship.

*Patent Pending

He knows that a nearby Producto warehouse can supply any catalog die set he needs...and that orders for specials are promptly processed. He can count on having the die set by the time he needs it.

The die maker has found that all of his requirements are met by Producto die sets. You will, too, when you place your order with Producto.

DIE SET DIGEST, our eight-page quarterly, contains valuable data for designers, makers and users of dies. Write to have your name added to mailing list.

THE PRODUCTO MACHINE COMPANY
925 Housatonic Ave., Bridgeport 1, Connecticut

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

Why The Mystery About Gage Materials?

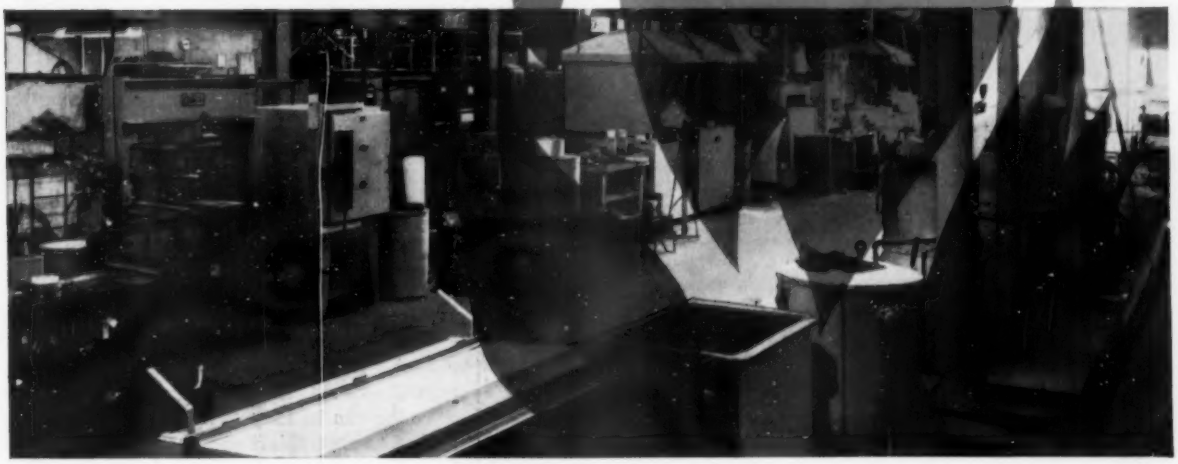
Extensive testing by The Pipe Machinery Company in customers' plants has proven High Speed Steel the best material developed so far for use in gages. Pipe Machinery is now offering working plug gages, through 1½" diameter, of this superior metal at no extra charge.

Years of experience has taught Pipe Machinery the best treatment for all their gage materials — and High Speed Steel is no exception. It is Nitrided for extra surface hardness in Pipe Machinery's own heat treating department where nothing is left to chance...where the most rigid standards guarantee uniformly high quality. As is the case with all Pipe Machinery gage materials, it is also submitted to a stabilizing treatment which further assures accuracy and long wear life for the finished gage.

Write today for additional information.

THE PIPE MACHINERY COMPANY

8810O Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland



DOW | MAGNESIUM

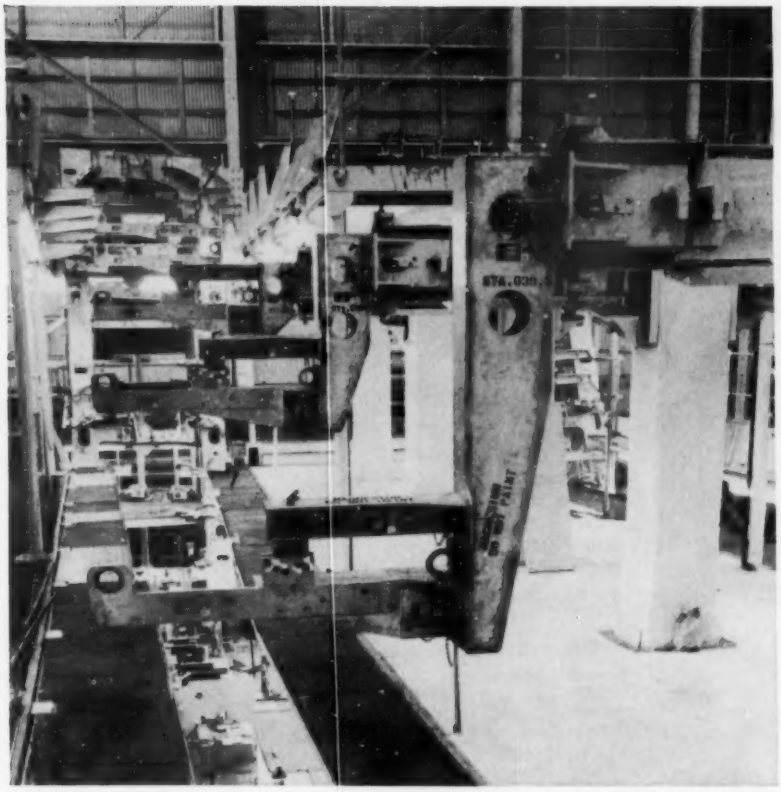
NEW BOEING 707 is first JET to fly in commercial service in the U. S. Extensive use is made of magnesium tooling plate in building the 707.

LIGHTER, FLATTER MAGNESIUM TOOLING PLATE

helps build new jet airliner

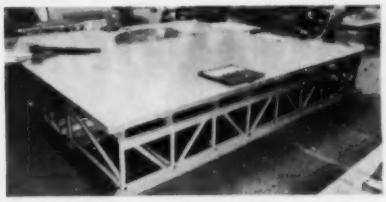
The use of magnesium tooling plate increases rapidly as more and more plants discover its important benefits. Weight savings, precision flatness, fast machining and dimensional stability are reasons for its use in many applications. Take Boeing, for example . . .

Magnesium tooling plate and extruded channels are in widespread use at Boeing's Renton, Washington, plant where the new 707 jet airliner is manufactured. Welded magnesium plate and channel are used as parts for an overhanging wing jig (see photo). Because of magnesium's lightness, such locators can be long and yet be rigid. Furthermore this lightness results in a less



severe load on the basic structure permitting it also to be lighter and less expensive. Other magnesium jigs which can be positioned and put in place by hand can easily be positioned without mechanical equipment. If made of steel, a sizable working party or a crane would be needed each time they were moved.

The top of a 20′ x 20′ master template table at Boeing was constructed of two thicknesses of 1½″ magnesium plate. No machining was required on the plates, permitting a substantial cost savings over a previous master template table made of steel plate, which required considerable machining. The stability of magnesium has maintained the necessary tolerances during use. A large 707 door locating jig also made of magnesium tooling plate can be handled by two men, and can be easily stored when not in use. The stability of welded magnesium structures in this and other applications is invaluable for large assembly jigs.



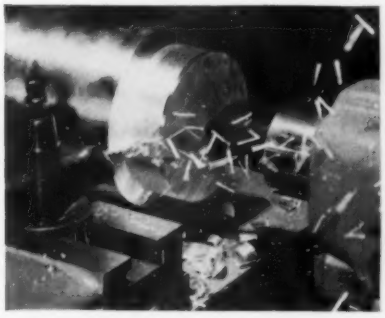
* * *

The lightness, flatness, stability and stiffness of magnesium tooling plate have likewise greatly increased its use as a base plate for plaster forms.

There are other advantages that make lightweight magnesium desirable as tooling plate material: Manually positioned welding jigs are easier to handle, weld spatter doesn't stick, high heat conductivity prevents warping from local heating, and nonmagnetic magnesium used for spot welding jigs causes no interference. Wherever magnesium tooling plate is used, it means less frequent use of lift trucks and other power handling equipment.

* * *

NEW MAGNESIUM TOOLING PLATE MANUAL. This handy, fact-filled reference book covers shop working characteristics, properties, design, etc., for magnesium tooling plate and tubing. For your copy, contact any Dow sales office or write to Magnesium Sales, THE DOW CHEMICAL COMPANY, Midland, Michigan, Department 1330FJ5.

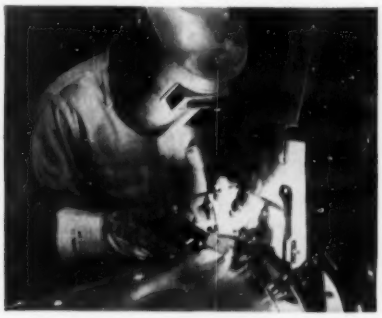


MACHINING TIME CUT TO SHREDS

Drilling, milling, reaming, sawing and other machining operations can be performed on magnesium with surprising economy. Magnesium machines faster and easier, reducing production time and tool wear to a minimum.

MAGNESIUM PLATE RESISTS BURNING

An acetylene torch fails to sustain ignition of magnesium tooling plate, even after prolonged contact. Reason: Heat is conducted rapidly away from point of application. Hundreds of metalworking plants work with magnesium tooling plate every day, yet the incidence of fires attributed to magnesium is very small.

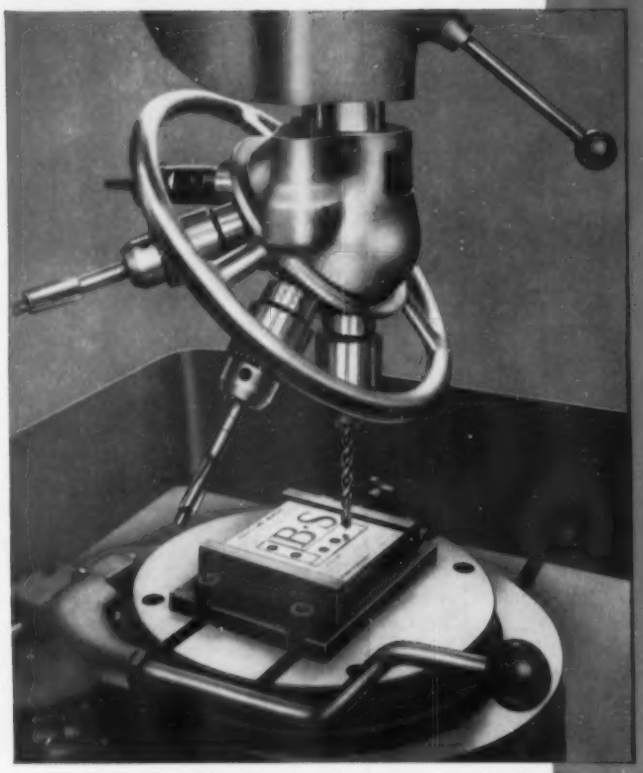


LONG SUIT: WELD STRENGTH

Magnesium tooling plate is easily joined by inert gas arc welding. High strength welds and joint efficiencies up to 95% are common. Any joint commonly welded with steel can be welded with magnesium, allowing exceptional versatility for tooling jobs. Magnesium can also be joined by common methods of mechanical fastening.

THE DOW CHEMICAL COMPANY · MIDLAND, MICHIGAN

Now... from Brown & Sharpe's the turret drilling machines



The Brown & Sharpe Turret Drilling method utilizes a machine on which all six spindles work on a single axis. As the turret is indexed from spindle to spindle, the tool in use is locked into accurate alignment with the main machine spindle. Simultaneously, the work is rapidly and accurately positioned by means of a Brown & Sharpe work-positioning table.

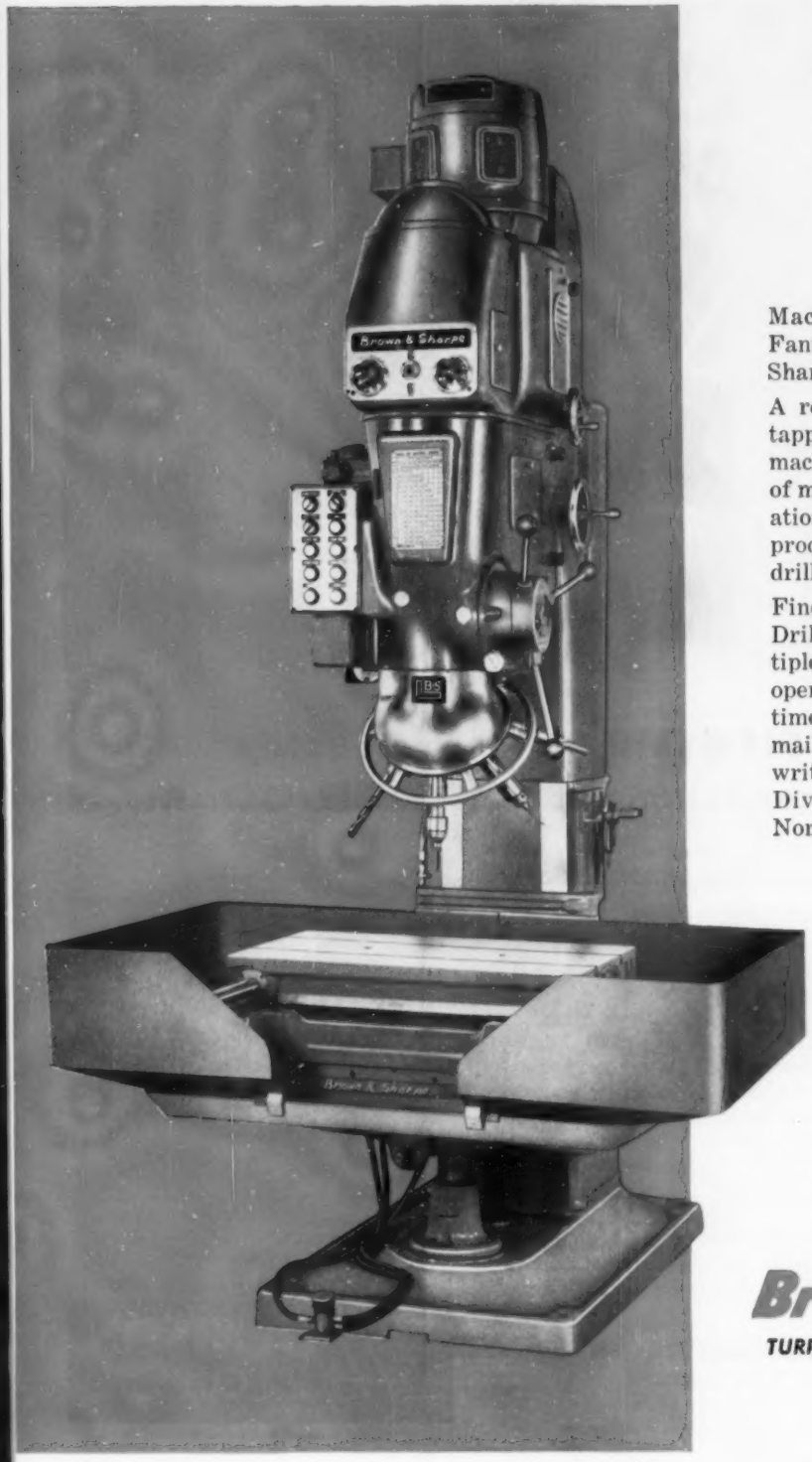
The result of this technique is an increase in production up to 5 times as compared with conventional multiple or gang-type drill presses.

MODEL A 6 spindles • ½" drilling and tapping capacity in steel • preselective spindle speeds, 200-4000 rpm, infinitely variable, on each spindle • preselective electrical tapping and depth controls on each spindle • table work surface 22"x24"

newest division...

that are saving up to 80% in

- drilling
- tapping
- boring
- reaming



Brown & Sharpe Turret Drilling Machines were developed by Howe & Fant, Inc., now a division of Brown & Sharpe Mfg. Co.

A revolutionary concept in drilling and tapping equipment, these turret drilling machines have been proved over a period of many years in all types of drilling operations, with records of 2 to 5 times greater productivity than with conventional gang drill box–jig methods.

Find out how Brown & Sharpe Turret Drilling Machines can help you make multiple savings in your drilling and tapping operations — in handling time, set-up time, capital investment, floor space and maintenance. For complete information, write: Brown & Sharpe Turret Drilling Division, Inc., 20 Fitch Street, East Norwalk, Connecticut.

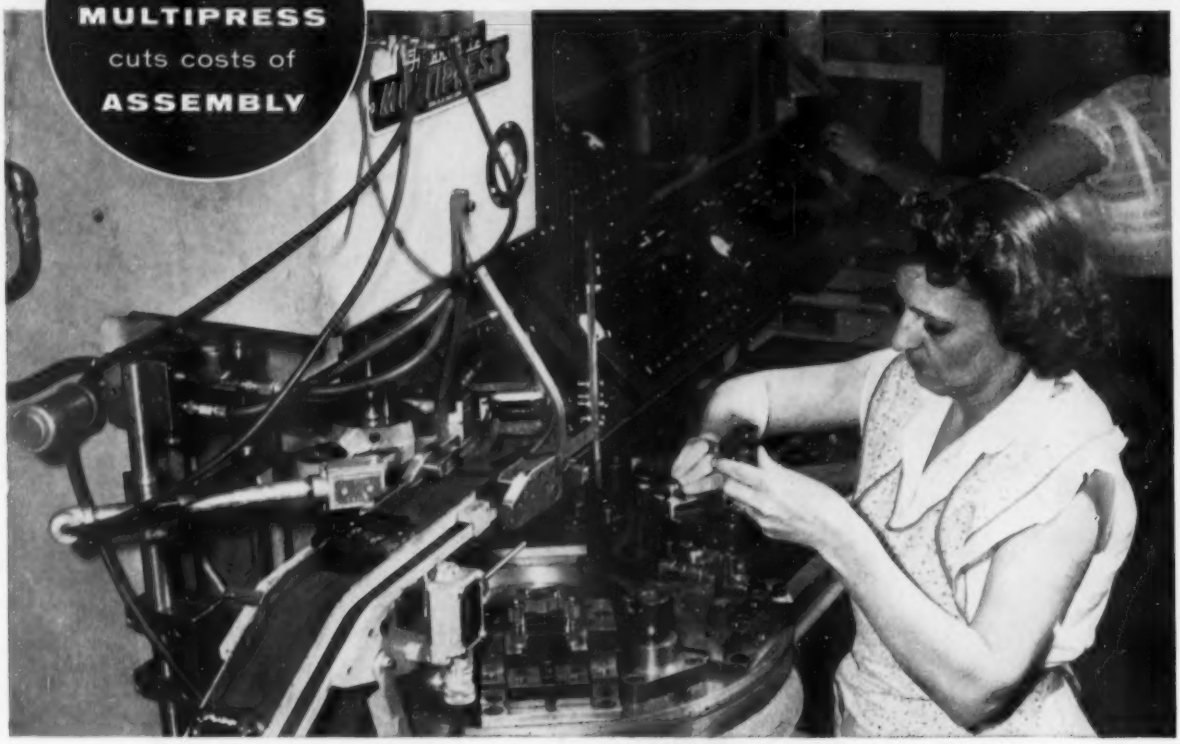
MODEL B 6 spindles • 1" capacity in steel • preselective spindle speeds, 125-2000 rpm, infinitely variable on each spindle • preselective spindle feeds, .0025-.021" per revolution, infinitely variable on each spindle • preselective electrical tapping control and depth control on each spindle • preselective turret index, manual or power • table work surface 28" x 32". Machine functions may be combined with any standard numerical control (tape control) system for fully integrated automatic machining and work positioning.

Brown & Sharpe

TURRET DRILLING DIVISION, INC.

How **DENISON MULTIPRESS** cuts costs of **ASSEMBLY**

ONE OF THREE, *this Denison 4-ton hydraulic Multipress is equipped with 6-station automatic index table to assemble both halves of lamination stacks of small electric motors.*



Savings with **DENISON** Multipress justify MAPI replacement recommendations at **BARBER-COLMAN**

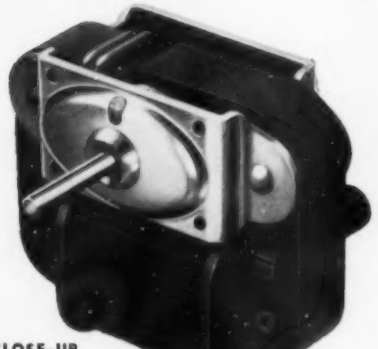
. . . line of 3 new hydraulic presses simplifies and speeds small motor assemblies

Installed upon recommendation of a MAPI replacement analysis, three Denison hydraulic Multipresses are today meeting predicted cost reductions in assembly operations at Barber-Colman Company, Rockford, Illinois.

Operating in a line and connected by conveyor belts, these three hydraulic presses handle—on a semi-automatic basis—such operations as bending, staking, aligning, compressing, riveting and stamping in the production and assembly of small electric motors.

In addition to more efficient handling of production functions, the quality of output is more uniform because exact pressure is duplicated on each stroke of the hydraulic ram.

Savings in cost and uniform production like this can be duplicated in your shop today. A cost reduction study by a Denison Specialist in press work can show you how. Write today for a descriptive catalog on the complete Multipress line.



CLOSE-UP
of Barber-Colman's low-cost, precision-made, AC non-geared motor . . . assembled by Denison Multipresses.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON HydrOILics

Denison, Denison HydrOILics, and Multipress are registered trademarks of Denison Eng. Div., ABSCO

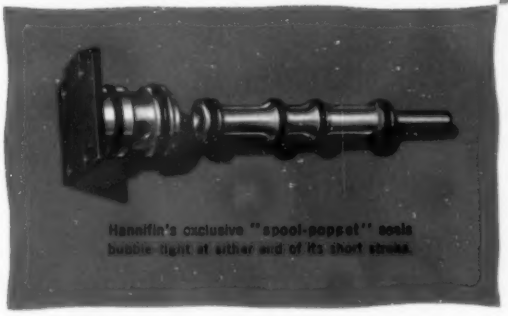
DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1182 Dublin Road • Columbus 16, Ohio

Denison Stocking Branch Offices: LOS ANGELES • HOUSTON
CHICAGO • DETROIT • ATLANTA • NEWARK • CLEVELAND

PARKER-HANNIFIN FLUID-SYSTEM COMPONENTS

From HANNIFIN... unit construction to give you air valves that do more jobs

Hannifin ⅜" four-way valve with "universal" base and new Speed Control section. Single-solenoid actuated, 10 other actuators available.



Hannifin's exclusive "spool-poppet" seals bubble-tight at either end of its short stroke.

For complete J.I.C. compliance, valve is electrically inoperative until dust-tight, splashproof solenoid cover is replaced and fastened tightly. Result: no more clogged, jammed solenoids.

One of the versatile—and most popular—Hannifin air control valves is this "CC" series, single-solenoid model. It is available for either ¼" or ⅜" air lines and is gasket-mounted to its own base. This particular base (one of three choices offered) can either be O-ring gasketed to your manifold or mounted over an opening in your bracket or machine. It will receive all four lines from below or take the inlet line from below and the two cylinder lines out one side. Or, you can make all connections at the sides.

When it comes to actuation, Hannifin offers an even wider selection: hand, foot, cam, pressure, single or double solenoid.

When necessary, you can remove this entire valve from its base without disconnecting air lines. Or, the exclusive "spool-poppet" can be replaced without even breaking electrical connections.

The "CC" series, like all Hannifin valves, is designed with "full flow" internal passages as large or larger than its rated pipe size.

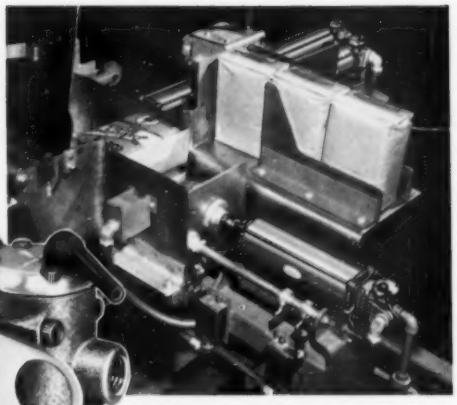
You will find these and most other Hannifin valves described in Hannifin's new "Valve Finder." Get your copy from your Hannifin man, listed in the A-Z volume of Thomas' Register, or write:

HANNIFIN COMPANY
525 South Wolf Road • Des Plaines, Illinois

A DIVISION OF PARKER-HANNIFIN CORPORATION

with the

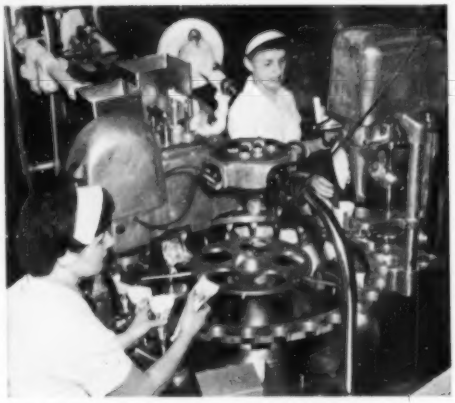
BELLOWS AIR MOTOR®



Packaging coffee is simplified by this Bellows Air Motor powered equipment.

...you can build special machines ...or modernize existing machines *at low cost and quickly!*

With parts normally available in every tool room, plus one or more Bellows Air Motors, and a little creative ingenuity, you can "spot modernize" scores of operations whose high cost whittles away at profits. The few illustrated here are typical of hundreds we can show you. The chances are good that no matter what you make, nor how you make it, this versatile air cylinder, with its *built-in* electrically controlled valve, can lend a mighty important helping hand to your cost reduction program.

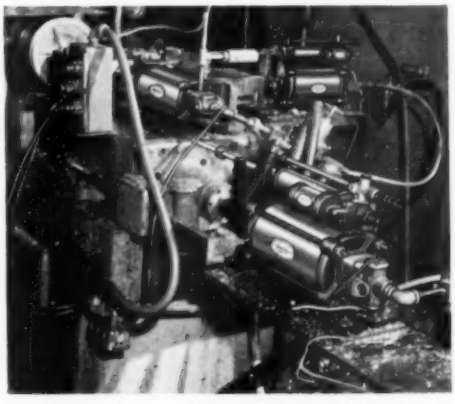


Bellows Air Motors fill ice cream, add nuts and fudge, fold and seal the wrapper in this special machine.

THIS FREE "SPOT-A-MATION FILE" MAY SPARK AN IDEA IN YOUR MIND THAT CAN MEAN IMPORTANT COST SAVINGS

A note on your letterhead addressed to Dept. TE-559, The Bellows Co., Akron 9, Ohio, will bring you basic data: wiring diagrams, installation details, equipment list, on a score of "everyday" operations almost every industry uses—and, if you wish, the services of a Bellows Field Engineer, to help you adapt those ideas to your specific needs.

1313-B



Tail stock, tool bit, and cross-slide are moved by Bellows Air Motors in this lathe conversion.

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

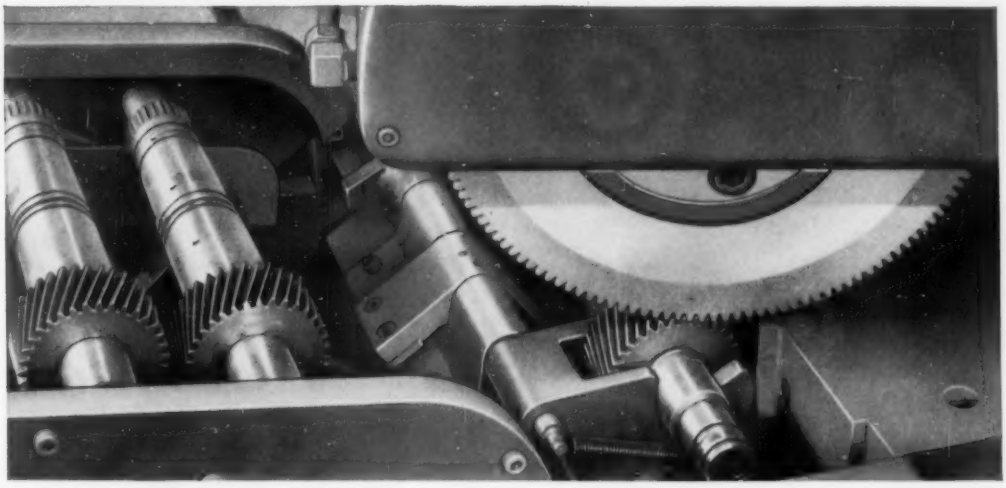
AKRON 9, OHIO

OTHER INDUSTRIAL DIVISIONS OF IBEC: Sinclair-Collins Valve Co., Valvair, Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio

Hard Gear Tooth Honing has completed the transition from an engineering research project to its present operational status in less time than any other major development in the field of modern gear practice. Why? Because Hard Gear Honing satisfies a long recognized need more economically than any other known process.

RED RING HARD GEAR HONING

Has Won Wide Acceptance



USERS

- The aircraft industry
- The automotive industry
- Computing machine manufacturers
- Motorcycle industry
- Tractor industry
- Gear manufacturers
- Electric motor (gear head) industry
- Machine tool builders

GEARS BEING HONED

- Transmission gears
- Timing gears
- Change gears
- Computor gears
- Main drive gears
- Motorcycle gears

PURPOSE OF HONING

- To remove nicks and burrs
- To improve surface finish
- To improve noisy gears
- To salvage rejects
- To quickly detect errors in prior machining
- To correct minor heat treat distortions

For complete details on Hard Gear Honing, write for Bulletin H-57-2.

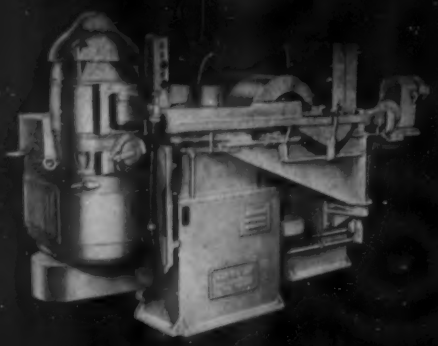
SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING,
GEAR HONING AND ELLIPTOID

B269

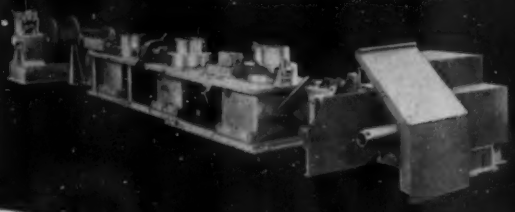
NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



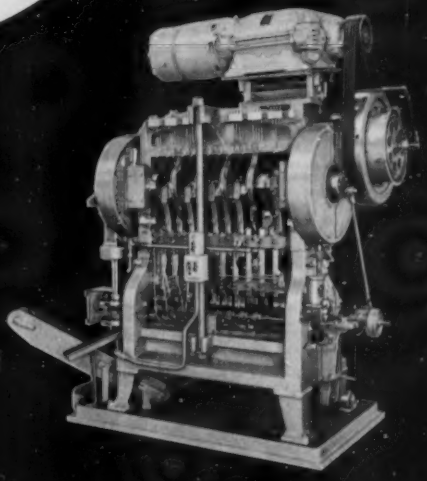
EYELET, SLITTER
& WIRE
MACHINERY



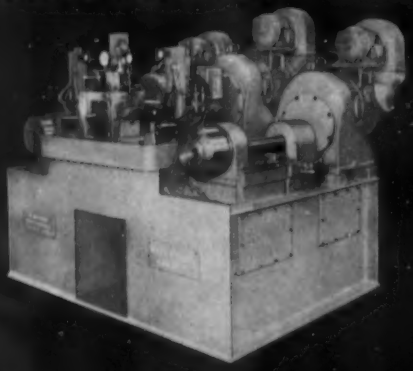
COLD HEADING
MACHINERY

WATERBURY
MACHINERY BUILDERS
FARREL

POWER
PRESSES



ROLLING MILL
MACHINERY



THE WATERBURY FARREL FOUNDRY & MACHINE CO.
DIVISION OF TEXTRON INC.
Waterbury, Connecticut • U.S.A.
Sales Offices: Chicago • Cleveland • Los Angeles • Millburn, N. J.

FLEXIBILITY + CUT-ABILITY = LONGER LIFE AND LOWER COSTS...

with SIMONDS

HARD EDGE

Metal Cutting Band Saw

Here's a tough, edge-holding band saw blade that gives a real bonus in smooth, fast cutting and long life. Made of rugged, wear-resistant alloy steel, Simonds "Bonus" Band Saws have sharp, perfectly formed teeth that are set with absolute evenness on both sides of the blade. Hardened along the tooth edge only by scientifically controlled heat treatment, they combine maximum cut-ability with flexibility and resistance to breakage . . . have an enviable reputation for dependable, trouble-free service. All standard widths, tooth styles and spacings are available from stock in coils or welded-to-length for all makes and types of band saw machines.

A "RIGHT" BLADE For Every Need

•

REGULAR TOOTH
SABRE TOOTH
SKIP TOOTH

•

REGULAR or WAVY SET

•

HARD EDGE
HIGH SPEED STEEL
SPRING TEMPER

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

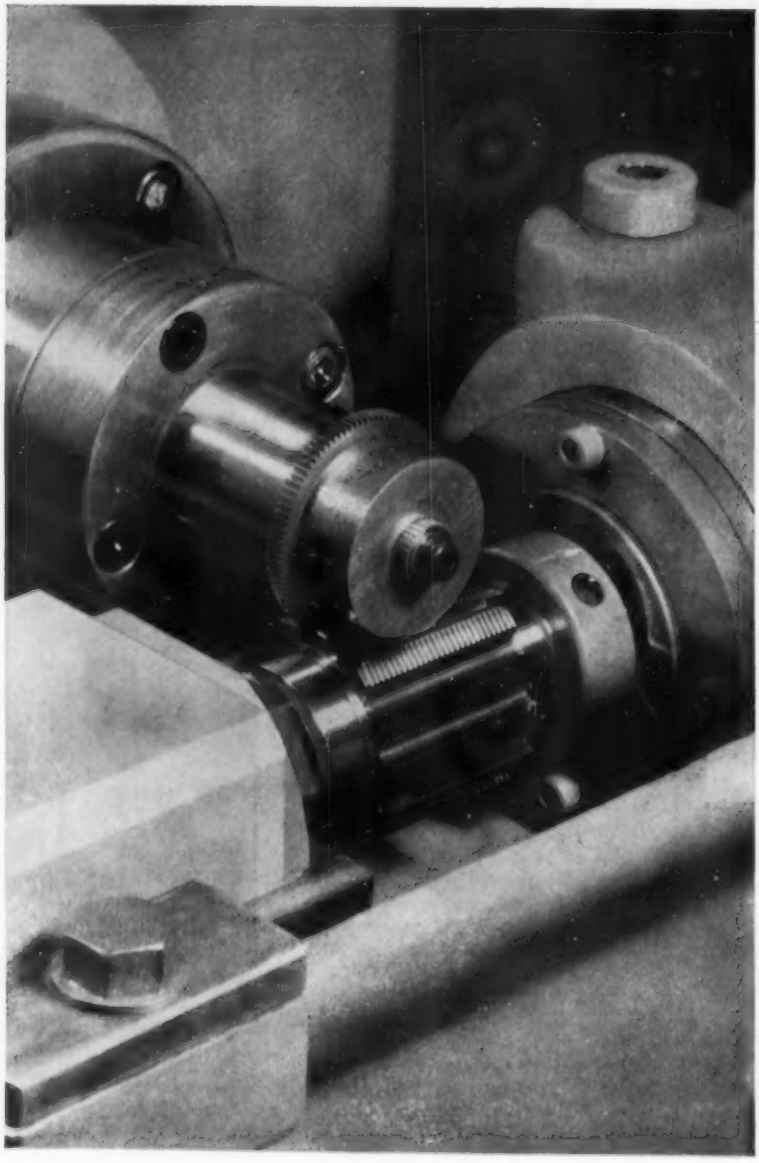
Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Oregon
Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomerstown, Ohio
Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

For Fast Service from Complete Stocks
Call your
SIMONDS Industrial Supply DISTRIBUTOR

INDUSTRIAL DISTRIBUTION THE RIGHT HAND OF PRODUCTION

New method of producing

AGMA Precision



Selection and segregation no longer necessary to insure precision-matched spur gear sets

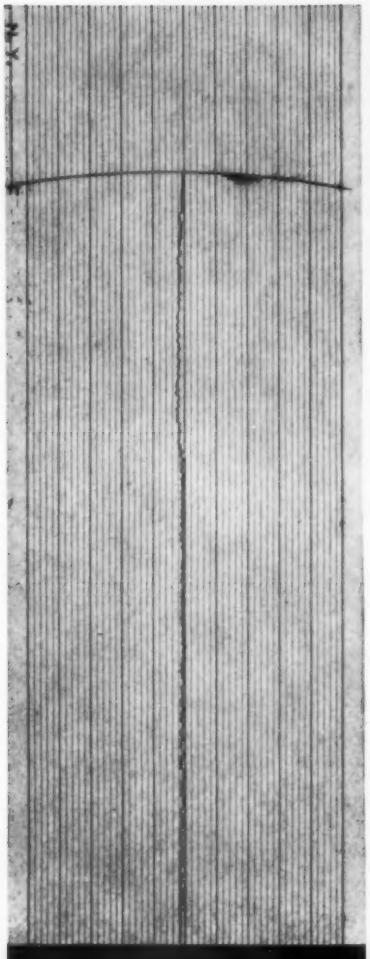
Selection and segregation — the process of producing more gears than you need in order to select a few that are within Precision Class 2 or Class 3 tolerances — is no longer necessary. And, these jobs at PIC Design Corporation, East Rockaway, L.I., New York, prove it.

In pioneering "Ultracision" accuracy for the missiles industry, Barber-Colman Company developed extensive machining and testing techniques now embodied in a new, low-cost hobbing machine—the No. 2½-4. For mass production of easily machinable parts which do not require such a high degree of accuracy, a high-speed version of this machine is available with a maximum hob speed of 2400 rpm.

Completely new hobbing machine

New concepts have been introduced into the Barber-Colman No. 2½-4 to bring you exceptional accuracy at a nominal cost. The No. 2½-4 is guaranteed to index accurately within 20 seconds of arc. This means that nonadjacent spacing error on a 2" dia. gear would be only .0001" due solely to the indexing error of the machine. When rigid tooling . . . accurate blanks . . . care in mounting the hob and work . . . Class AA hobs . . . and accurate hob-sharpening methods are used, it should be possible to hob AGMA Precision Class 2 and Class 3 gears without selection and segregation. Scrap and inspection time are reduced. And, in many

Class 3 Gears



Each line on tape represents .0001". This Precision Class 3 gear was obtained with only slightly more care than required for Class 2 gears.

cases, deeper savings can result from the elimination of finishing operations.

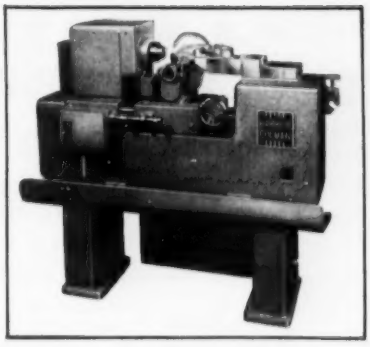
The accompanying PIC "true blue" gear tape shows the inspection record of a Precision Class 3 gear. On the production run, all gears had a total composite error of less than .0004". The gears have 96 teeth of 64 DP. The tape is made on a variable center-distance checking machine with a motor-driven master gear which rolls under preset pressure with the cut gear. After the work spindle adapter and the hob were trued within .0001", no further adjustments were necessary for hobbing gears of this accuracy.

The No. 2½-4 accommodates 3" dia. hobs, permitting maximum number of flutes for cutting accurate, smooth tooth profiles. Maximum work diameter is 2½" and length of cut is 2¼" — for steel gears as coarse as 30 pitch or brass up to 20 pitch.

PIC pursues accuracy in every corner of production

As you examine the results being achieved with the No. 2½-4 by PIC Design Corporation, you will see that in their pursuit of predictability and precision, no stone is left unturned.

Bores of Precision Class 2 and 3 gear blanks are machined to + .0002", - .0000" for size and roundness. Before turning, blanks are mounted on arbors the same size as the bores, with a .0002" taper. They are inspected for face wobble and must run true within .0002" per inch of diameter before the OD's are turned to a concentricity tolerance of .0001". This operation is checked at two points, 180 deg. apart.



In hobbing, the arbors are held in a floating adapter which permits fine adjustment to desired concentricity. PIC uses only Barber-Colman Class A or AA hobs, trued on the machine to less than .0001" runout.

Evaluate your gear processing and costs

If you have the problem of producing precision fine-pitch gears at a profit or want to improve your product by increasing gear accuracy, a Barber-Colman process analyst will help you evaluate methods, tooling, and cost improvements. Phone your B-C representative or the factory — WO 8-6833.

Barber-Colman Company

BARBER COLMAN ®

53 Loomis Street, Rockford, Illinois

Job Facts:

Existing equipment: #2 Snow vertical drilling machine
Part: mounting base for power transistor
Material: electrolytic tough pitch copper
Thread: 10-32
Production: 1000 parts per hour

ONE *Acme-Fette Thread Rolling Head*

Thread Rolls 5,000,000 Pieces

without major investment

"A standard thread rolling machine would cost from seven to eight times more money than is invested in our Acme-Fette Thread Rolling Head *and* the existing equipment on which it is installed", says H. M. Oshry, Vice President of Steel Industries, Inc., Crawfordsville, Indiana.

The extremely rugged head achieved this outstanding production record with only three sets of thread rolls, producing threads with consistently closer tolerance and uniformity. A higher tensile strength is also obtained, and the resulting surface hardening provides a surface quality not achieved by any thread cutting method.

Acme-Fette Heads roll all parallel thread forms from 1/16" to 2" at speeds equal to turning speeds with high speed tools . . . up to 5 times faster than conventional thread cutting. For cost reducing ideas showing how you can put these heads to work on your *present* equipment, send for Bulletin NAF-57A.

National Acme

The National Acme Company
193 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

Officers

George A. Goodwin
President
Dayton, Ohio

Wayne Ewing
Vice President
Los Angeles, Calif.

H. Dale Long
Vice President
Chicago, Ill.

William Moreland
Vice President
Ashland, Ohio

David A. Schrom
Vice President
York, Pa.

Philip R. Marsilius
Treasurer
Bridgeport, Conn.

Charles M. Smillie
Secretary
Detroit, Mich.

Harry E. Conrad
Executive Secretary
Detroit, Mich.

Allan Ray Putnam
Asst. Executive Secretary
Detroit, Mich.

Board of Directors

G. A. Goodwin *Chairman*
Dayton, Ohio

G. Ben Berlien
Oakland, Calif.

I. H. Buck
Dallas, Texas

C. E. Chapman
Gary, Ind.

H. E. Collins
Houston, Texas

Wayne Ewing
Los Angeles, Calif.

Bruce Fairgrieve
Toronto, Ontario

Frank Ford
Atlanta, Ga.

H. Dale Long
Chicago, Ill.

P. R. Marsilius
Bridgeport, Conn.

W. J. Pender
Pawtucket, R. I.

Joseph L. Petz
Poughkeepsie, N. Y.

David A. Schrom
York, Pa.

L. C. Seager
Salt Lake City, Utah

Francis J. Sehn
Bloomfield Hills, Mich.

Editorial Committee

Donald E. Zierk *Chairman*
Dundee, Ill.

Harold Sullivan *Vice Chairman*
Minneapolis, Minn.

John C. Hatter *Vice Chairman*
Long Island, N. Y.

Leo Tarasov
Worcester, Mass.

William Moore
Riverside, Ontario

A. R. Jones
Seattle, Wash.

Progress

Another year of Society progress is on the record. In spite of many adverse economic conditions, most of the pledged objectives of the past administration have been realized.

Our membership has passed over the forty-thousand mark, our communications have been improved, our educational program is sound and the long-range planning study instituted by the Board of Directors should prove one of the most important undertakings in recent years, assuring future progress for ASTE.

The Annual Report published in this issue will testify to the many hours of dedicated effort contributed by your officers, directors, national committees and headquarters personnel. Harmony and cooperation have prevailed in all our activities. All credit should go to those who have so unselfishly supported my administration.

I have the greatest confidence that our progress will continue under the leadership of our new officers and directors. The membership can be proud of their selection.

Serving you as president for the past year has been a wonderful experience. The meeting of many new friends and the strengthening of old ties has been most inspiring.

I deeply appreciate the opportunity of having served as your president.

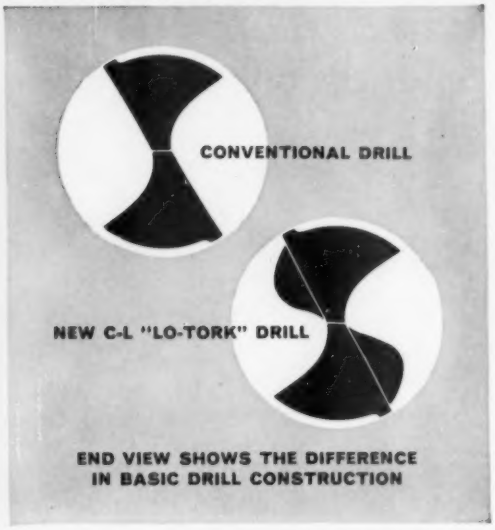
G. A. Goodwin

IMMEDIATE PAST PRESIDENT
American Society of Tool Engineers

FROM *Chicago-Latrobe* RESEARCH AND ENGINEERING

AN UTTERLY NEW DESIGN OF TWIST DRILL

The NEW C-L "LO-TORK" BRAND Chip Breaker Drill



PATENT APPLIED FOR

UNRETOUCHED PHOTOS (BELOW)...dramatic proof of C-L "Lo-Tork" Drill's chip breaking effectiveness. At left is conventional drill—At right is the "Lo-Tork." Same work piece in each photo.

Completely New! C-L "Lo-Tork" Drills end stringy chips . . . speed production . . . improve lubrication

• This announcement may be of great importance to your plant. Chicago-Latrobe research has produced a chip breaking drill that *works*. Utilizing a unique profile, the C-L "Lo-Tork" Drills not only reduce chips to manageable size, but greatly increase the flow of coolants to the drilling point. These drills have been exhaustively tested on production machines in numerous plants. C-L "Lo-Tork" Drills may well be the final answer to your problem of stringy chips. Get full information at once.

WRITE FOR DESCRIPTIVE LITERATURE . . . OR CALL YOUR C-L DISTRIBUTOR AT ONCE

CHICAGO-LATROBE DRILLS · REAMERS · END MILLS · COUNTERSINKS · CARBIDES · SPECIALS

411 W. ONTARIO STREET, CHICAGO 10, ILLINOIS

machine tool selection ...some basic considerations

By Richard F. Thuma
Superintendent—Tools and Maintenance
Industries Group
Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

Is it better to buy a new machine or modernize an older one? Should a standard machine be adapted for special operations or should a special-purpose machine be acquired? There is no one "right" answer to these questions. The author lists pertinent considerations and illustrates them with examples from actual operations.

Abstracted from Paper 189, "Machine Tool Selection and Application in a Large Industrial Plant," presented at the 27th Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

GREATER PRODUCTIVITY is one of the primary objectives of all tool engineers. This objective is achieved by studying all aspects of manufacturing operations and acting on the results of those studies. Productivity of existing machines can be increased, for example, by decreasing idle time. Loading and unloading can often be expedited by improved tooling or material handling methods. Making it possible to set up one job while another is being machined greatly increases productivity. Multiple setups around a drill press, and extending bed travel and floor plates on a horizontal boring mill are examples. Planning ahead to make sure that the next job and appropriate tooling are ready at the machine is another way to improve productivity.

New developments in cutting tools enable more pounds of chips per minute to be cut, provided that existing equipment has the necessary power, speeds, feeds and rigidity. Older machines can sometimes be speeded up and repowered to use new cutting tool materials effectively. Some old machines, considered obsolete, are basically sound and can be modernized at less than half the cost of new equipment. New parts are added, power increased and controls replaced to obtain greater speed of operation and accuracy. Often, the existing foundations

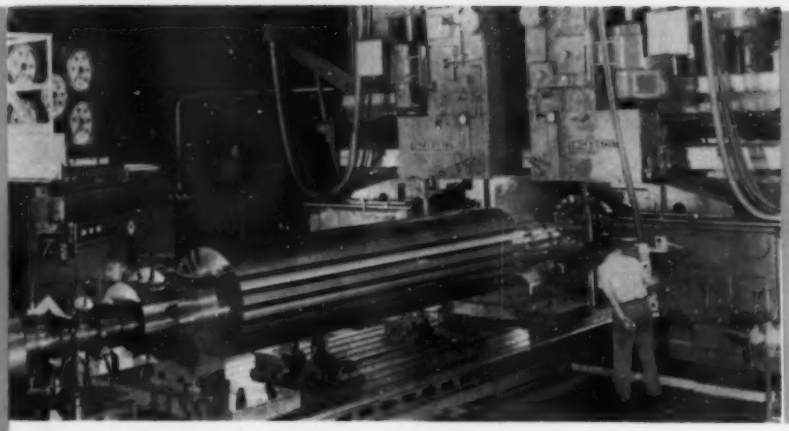


Fig. 1. Machine to mill slots in electrical rotors. When slotting rotors, one side head and one rail head are fastened together and the motor on the rail head is used to drive the cutter. The side head is used as an outboard support for the cutter. When heads are disconnected, the machine can be used as a conventional four-head milling machine.

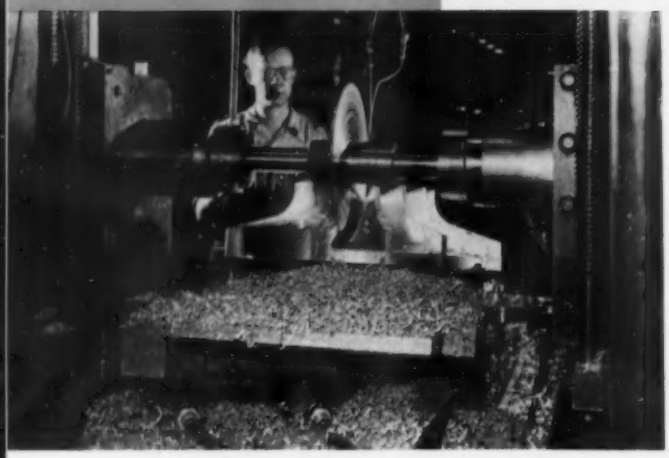


Fig. 2. Stock is removed between vanes of impeller by oscillating part under a milling head. Oscillation is effected by a hydraulic drive, controlled by limit switches and solenoid-operated valves.

are good and can be used with minor alterations at much less cost than installing a special foundation for a new machine.

New Equipment

If, after all these possibilities are considered, current requirements cannot be satisfied, new equipment is the only possible solution. When increasing productive capacity, consideration is usually given first to the possibility of installing a modern counterpart of an existing machine. This is particularly true when large equipment is required. The modern machine will usually be more efficient, faster, more powerful and more convenient to operate, with up-to-date centralized controls. It will permit use of carbide cutting tools and may be 80 to 100 percent more productive than older machines and require less maintenance.

A modern counterpart may also be the best solution when considering smaller machines. This is especially true of standard machines, such as milling machines and turret lathes.

Replacing an existing machine with a modern counterpart is not always the best way to increase productivity. Often, a different type of machine can perform the same operations. If production involves a diversified line of products, machine versatility is extremely important in order to hold the number of machines to a minimum. An example is the rotor slot milling machine shown in *Fig.* 1. This machine can also be used as a standard adjustable-rail milling machine. Size and configuration of parts may well mean compromise as to machine type. The best machine for individual products may not be the best for all.

Another consideration is the need to maintain a well-balanced complement of machines for constant flow of production. There should always be an alternative method of manufacture to permit increased production or to give protection against work stoppages caused by major machine breakdowns. Obviously, most companies cannot afford to purchase a million-dollar boring mill as a stand-by unit in case of emergency, so this consideration is particularly applicable in the case of large or highly specialized machines.

With smaller machines, versatility is not so important, since there are generally many small standard machines available. Since these smaller machines are relatively inexpensive, it is usually possible to specify the ideal type for certain sizes of part; fewer compromises are needed.

A third method of increasing productivity is to change the method of manufacture and acquire the standard or special equipment required. Usually, such basic changes are impossible with larger parts. There are only a few possible production methods, and these generally involve certain types of equipment. Nevertheless, there are exceptions to this rule. Practically all large industrial plants have

applications where it is possible to profitably employ large special equipment to perform operations on a specific type of part, or certain specialized operations on many types of parts. A careful study of alternatives is required.

Changes in manufacturing methods offer tremendous potential savings when dealing with smaller parts. The possibilities range from completely automated lines with transfer equipment where the part is machined without human intervention to the use of standard machines with minimum tooling. The decision to use full automation or minimum tooling or any intermediate possibility is predicated on the production volumes required and relative cost factors.

New machine tools can increase plant productivity and reduce costs. There is a third reason for considering new machine tools—the need to meet new or changed product specifications. For new products not previously manufactured, additional machines may be required or new types of machines (including special machines) may have to be procured. If parts are larger than can be accommodated on existing machines, the need for new machines is obvious. Similarly, new part configurations may require types of operations that cannot be performed on existing machines. An example is a change from circumferential to axial grooves in steam turbine spindles. A change from lathe operations to milling and broaching operations is mandatory. New materials such as the high-temperature alloys make it necessary to grind parts that were previously milled. Changed tolerances also may require changed methods of manufacture and different machines.

Selecting a Machine Type

To illustrate the problems involved in selection of large machines, a hypothetical case will be discussed. The part involved is in the twelve-foot size range. Three types of machines can accommodate the part: a 12-foot vertical boring mill, a horizontal boring mill and a 12-foot adjustable-rail milling machine. Each of these machines will, of course, perform operations the others will not do and each is best for certain applications.

The 12-foot boring mill can bore and turn even the largest parts with high accuracy. Two tools can be used and heavy cuts can be taken. It can face both round and square parts and occupies the least floor space of any of the three machine types. It is not as versatile as the horizontal boring mill but has greater versatility than the adjustable-rail mill. It costs more than the horizontal mill.

Disadvantages of the vertical mill are the high power cost and limited speed associated with rotating large parts. Length of part is limited, usually to a 12-foot maximum. Machining is slow when facing parts where the tool is "cutting air" much of the time, as is the case with rectangular flanges. A second part cannot be set up while one part is being machined and normally only one part is machined at a time.

An adjustable-rail milling machine, on the other hand, is the most productive machine type of the three for facing operations. Two to four operations can be performed simultaneously, using all heads. Several parts can be machined at one time; with a split table, a second job can be set up while one job is being machined. Finishes are excellent.

Fig. 3. Planer has been permanently converted to machine radii on tools. Pivoting plate is mounted on special base in foreground.

The adjustable-rail machine, however, is the least versatile type of the three. Turning and boring operations cannot be performed on this machine. Floor space requirements are higher than for the other two machines. Also, adjustable-rail machines are more expensive than the other machines and work pieces must be within certain size limits.

The horizontal boring mill is the most versatile machine of the three. It can perform milling, boring, facing, drilling, reaming and tapping operations. Initial cost is the lowest of the three machine types and there is practically no limit to workpiece size. The range of the machine can be extended at nominal cost. Parts can be contour milled without "cutting air" and a second piece can be set up while a piece is being machined. The workpiece is stationary and the tool moves, making it possible to obtain high surface speeds when boring small diameters.

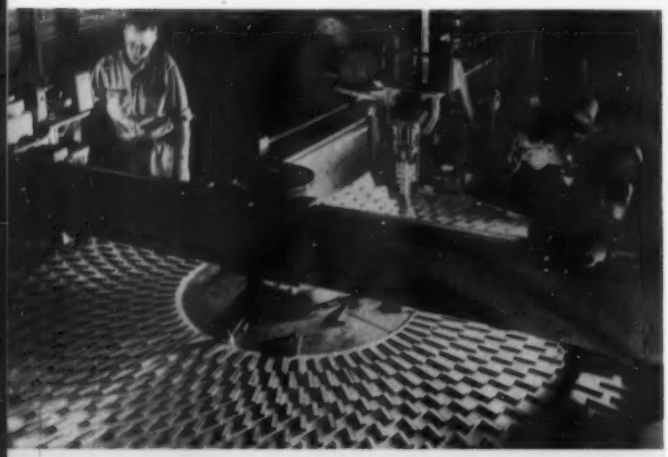


Fig. 4. Three-head indexing machine positions and glues spacers onto transformer washers.

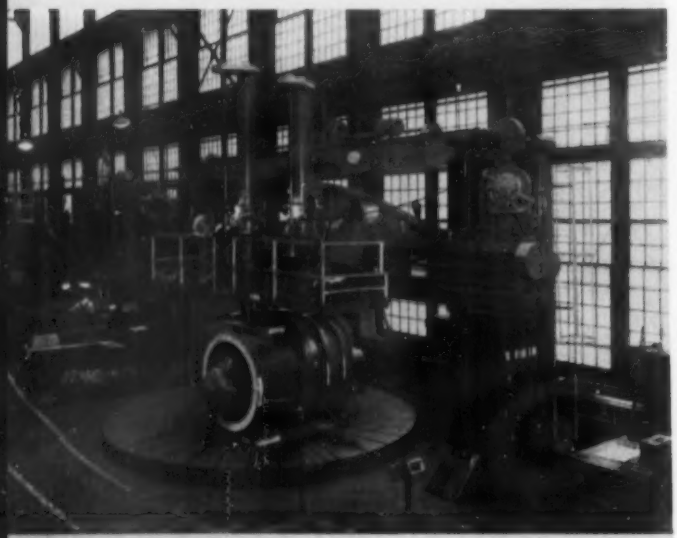


Fig. 5. Rebuilt 28-foot vertical boring mill. Performance proved excellent and conversion costs were moderate.

Disadvantages of the horizontal boring mill are inability to perform turning operations (except for stub turns); lower productivity than a vertical boring mill; and the fact that the machine has only one milling cutter as compared to two or four for an adjustable-rail machine.

After possible applications of each type of machine are studied, requirements can be reviewed on the basis of the types of parts to be machined. Production quantity requirements are equally important. Parts on order and sales forecasts must be taken into consideration, as well as present facilities to make those parts.

The choice of size or type of new equipment for new parts is also affected by the possibility the equipment can be used to manufacture existing parts more efficiently. An example is a case where large vertical boring mill capacity was inadequate. Condenser parts were being machined on this equipment. The purchase of a large horizontal boring mill made it possible to machine these parts more efficiently and released vertical mill capacity for other parts. In this case, the horizontal boring mill was less costly than a new vertical mill and actually gave greater over-all plant capacity because of the product mix.

Cost studies are essential when making equipment decisions. These usually involve the relative cost of making parts on various machines, including the burden cost associated with each machine. The total cost of equipment includes the initial cost, the maintenance cost and burden. Cost of cutting tools and cutter grinding should be considered. These costs would be much higher for a milling machine than for a vertical boring mill, for example.

Studies of the relative merits of various machine types for a job, plus cost studies, make it possible to determine the specific machine that is needed. Frequently enough of the known facts are so obvious that the choice of types may be immediately narrowed to two, or even one, machine types and the study is greatly simplified.

Machine Specifications

When the type of machine has been determined, specifications are established. Large machines are manufactured to fit customer requirements. Machine tool companies cooperate fully in developing specifications and often make valuable suggestions. Among the items to consider are:

1. Basic size dimensions
2. Load carrying capacity

3. Feeds and speeds
4. Power
5. Type of control
6. Tolerances of parts to be machined
7. Special features required
8. Standard company requirements as to types of motors, safety guards, bearings, way materials and instrumentation.

Safety must be given consideration from the time the need for the machine is conceived, through the design and specification stages, and also during installation and operation. Safety should be built into the machine, not added as an afterthought.

The combination of a standard machine and special tooling is often the only feasible approach to the manufacture of a new part. This was the case when planning for a new part—a centrifugal compressor impeller, *Fig.* 2. This part was a forging. The number of units required would not justify an expenditure for a special machine and, in any event, there was not time to design and build such a machine.

An adjustable-rail planer type milling machine was selected with the cutter arbor driven by one side head and supported by the other. A pie-shaped area was machined between the vanes by oscillating the part under a carbide-tipped cutter. The tips of the blades were later "curled" in a forming die.

Although the principal problem was to remove the stock between the vanes, vane thinning and tapering were also required. Since indexing and holding were already provided in the oscillating fixture, it was relatively simple to arrange the fixture to perform the additional operations in the same setup and on the same machine. This necessitated providing sine bar adjustment for the various operations. Six of the 25 operations necessary to make the part were done on the fixture.

A permanent conversion of a standard machine for a specialized operation is illustrated in *Fig.* 3. This planer is used to machine large radii on tools. While a full range of boring mill sizes is available, producing tool radii on such equipment was inefficient; at least 90 percent of the time the boring machine was "cutting air" when used to produce tool radii. In addition, producing tools on production equipment interfered with production schedules for parts and tools alike. The converted planer makes it possible to do the work with toolroom accuracy, using toolroom operators, at greatly reduced costs.

The machine is unusual but not complicated. A second base is mounted at a right angle to the planer base. A slide with a pivot point is mounted on the second base. Normal reciprocating action of the planer moves the part clamped on the slide around the radius desired. A pin mounted at the pivot point is used to accurately set part size.

The planer installation was so satisfactory that similar equipment was also built for a vertical milling machine. Small parts can be efficiently made on the milling machine and, by using form cutters, it is possible to machine radii that would be difficult to produce on the planer.

Some operations are so unusual that they require highly specialized machines. The machine shown in

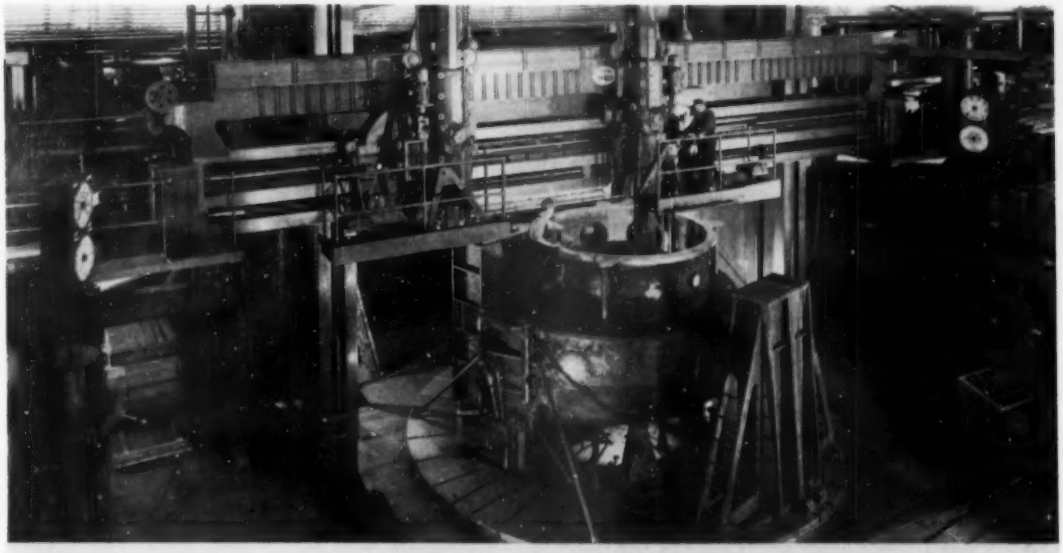


Fig. 6. New 30-foot vertical boring mill is equipped with large dials so that speeds and other operating information are visible to operator at all times.

Fig. 4 was designed to glue spacers onto transformer washers. The spacers provide ducts for cooling air to pass through the transformer cells. The machine, which is equipped with three heads, indexes automatically and glues the spacers in place in a matter of minutes.

Rebuilding and modernizing older tools such as the vertical boring mill shown in *Fig.* 5 can pay dividends. This machine was built in 1905 and modernized in 1956. A complete new drive was installed, including a new adjustable-speed d-c motor with pushbutton controls, a three-speed gearbox complete with double helical gears and antifriction bearings, and a new cone worm final drive gearbox having a hardened pinion and a forged steel alloy helical table gear. The table way material was changed and an antifriction center bearing post assembly installed. All worn parts were rebuilt or replaced. Maximum table speed was increased from 2.5 to 7.5 rpm and power was increased from 35 to 100 hp. Performance and accuracy compare favorably with new machines and, although extensive foundation modifications were required, total cost was less than 40 percent of that for a comparable new machine.

The degree to which special features are incorporated into "standard" large machines is illustrated by the vertical boring mill shown in *Fig.* 6. This mill has a swing of slightly over 30 feet with a height under the tool of more than 17 feet. Table capacity is 200 tons and the machine is equipped with two 150-hp drive motors. Table speeds for turning and boring operations are from 0 to 13 rpm, infinitely variable. The machine has electronic feeds that are also infinitely variable.

Specifications were established jointly by Allis-Chalmers and the manufacturer. All operations can be controlled from a master console and a second console is also provided. On each saddle there is a control station for the primary motions of the table such as start, stop, reverse, slow down and speed up, and also the operation of the individual head. The machine has a milling head and the table is provided with milling feeds. Minimum table speed is one revolution in 8½ hours.

Instrumentation is also special. Large dials show table speed, speed in inches per minute for each saddle or bar and also the percentage of the power available at that speed that is actually being used.

Special features were also required on a large engine lathe, *Fig.* 7. This lathe has a 148-inch swing and will hold a 60-foot long piece between centers. It has a 200-hp drive motor with infinitely variable speeds from 0.5 to 60 rpm and electronic feeds from 0.002 to 1.000 ipr. To meet accuracy requirements, the headstock and tailstock are mounted on anti-friction bearings that have axial and radial tolerances of less than 0.0005 inch per revolution. A taper attachment permits machining 14-foot long tapers with a 24-deg included angle in a single pass.

Steady rests are designed to take either roller or flat thrust shoes, which can be interchanged without removing the workpiece from the machine. The steady rests themselves can be removed from the machine without disturbing the workpiece. Electrical interlocks and limit switches are provided throughout the machine to reduce the possibility of collision between machine elements. The machine can be operated from either the front or back tool posts, but only from one at a time. A chip conveyor runs the full length of the machine, with a tunnel so that a man can walk upright to service the conveyor as required.

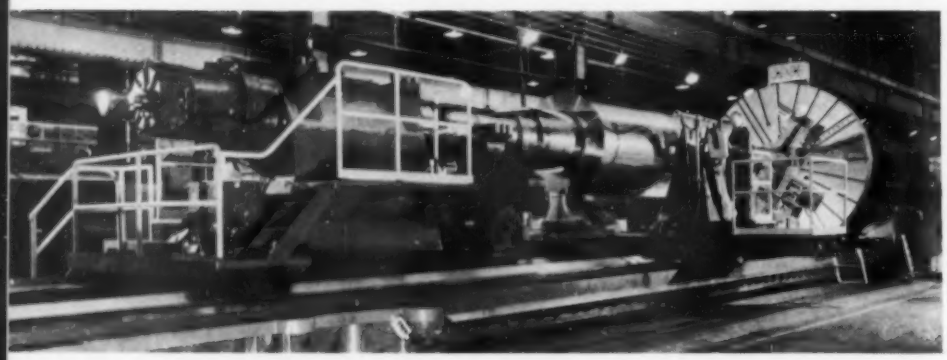


Fig. 7. Engine lathe for machining rotors can accommodate 200-ton parts up to 60 feet long.

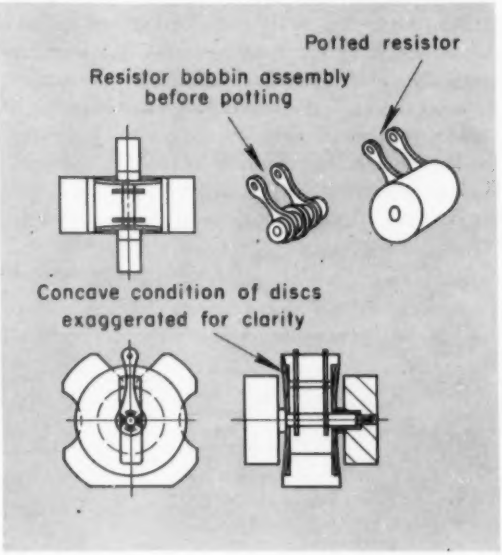
The examples discussed show how one company has found it profitable to convert standard machines for special operations in some cases, to rebuild obsolete machines in other cases and often to purchase new equipment, either standard or special. The over-all policy is to obtain the greatest amount of productivity for the lowest possible cost. For a given job, any one of these alternatives may be the most satisfactory solution.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Resistor Potting Fixture

This simple fixture assures total reliability in potting resistors, without leakage or flashing of the potting compound, regardless of the variation in the length of the resistor bobbin within its prescribed tolerance. Width of the mold body is established between the faces of the counterbores so as to provide a minimum concave distortion of the spring-tempered disks at the maximum length of the resistor bobbin. The slight concave condition at the end faces of the potted resistor caused by variation in the length of the resistor bobbin is not objectionable.



In operation, one of the flat disks is slip fitted onto the arbor, the resistor bobbin assembly is slip-fitted onto the arbor and this assembly is inserted into the mold cavity with the disk slip-fitted into the counterbore and against the counterbore face. The remaining flat disk is slip fitted onto the arbor followed by the counterbored special wing nut. Screw pressure of the wing nut forces the thin flat disks against the faces of the counterbores and the hubs of the resistor bobbin, thus providing a leak-proof seal between the mold cavity and the mold core.

The mold body is nylon. The flat disks are spring-tempered stainless steel or berryllium copper. The arbor is made of drill rod or stainless steel with a counterbored wing nut to suit. Selection of materials is, of course, a matter of choice. However, the mold cavity and the flat disks should be polished.

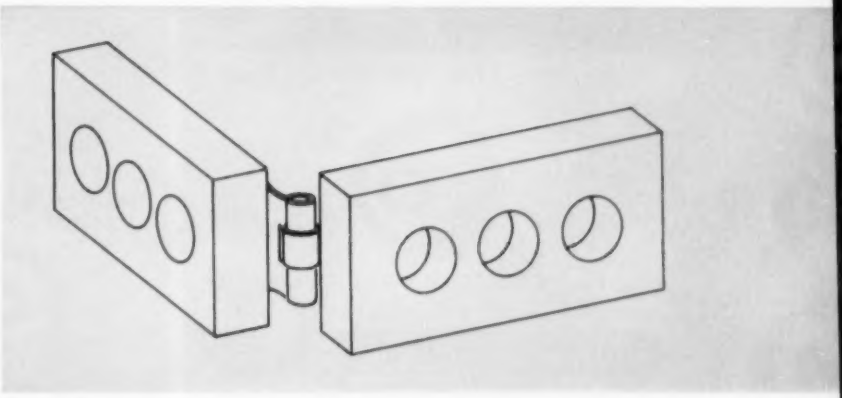
Although this fixture was designed for short-run production, the simplicity of design and complete interchangeability of parts make it readily adaptable to automation. The piece part and fixture parts could easily be oriented for automatic assembly and metered filling of the potting compound, then passed through heat for curing the compound, automatically disassembled and the finished piece part ejected. Fixture parts would then be automatically sorted and moved to their respective loading stations for the next cycle.

John D. Deeds
Indianapolis, Ind.

Hinged Parallel

Parallel bars are used extensively in the shop to support work while performing drilling and other operations. Ordinary parallels are hazardous unless the base is wide to provide good support. Hinged parallels such as those shown are less likely to fall over when work is placed on them.

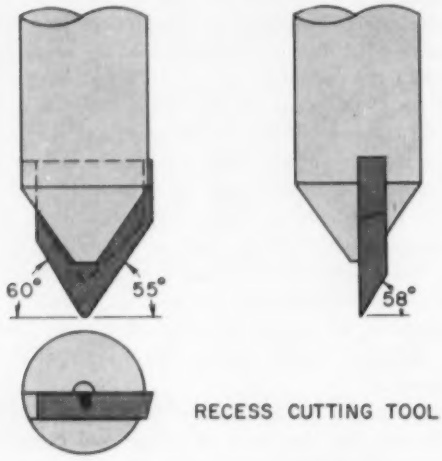
William Martin
Brooklyn, N. Y.



Milling a Blind Recess

Machining a blind recess with sharp (small radius) corners is usually considered a difficult or even impossible operation. With the tool and technique illustrated, such operations are greatly simplified.

The tool is made by inserting a carbide or high-speed steel blade in a slotted rod. A single cutting edge is ground to an angle of 55 degrees to the center line. A more exact value for the angle is 54 degrees, 44 minutes, 22 seconds. The other angles to which the tool is ground are not critical. Point radii depend on the size of the tool and work, and the amount of material the tool is to remove. When necessary, two tools can be used: a roughing tool with a large radius and a finishing tool with a somewhat smaller radius.

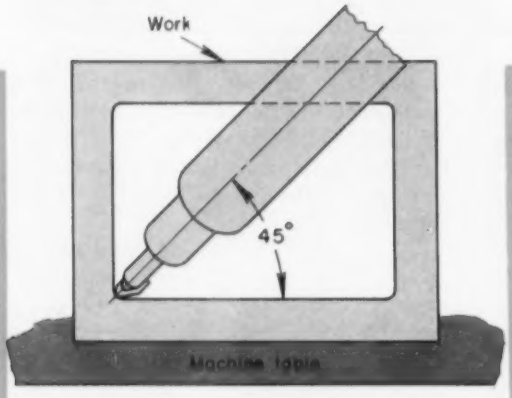


RECESS CUTTING TOOL

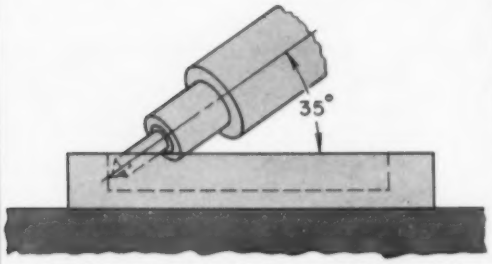
In use, the tool is set in a vertical milling machine and the head is adjusted so that it is tilted at an angle of 35 degrees with respect to the bottom of the cavity being machined and at an angle of 45 degrees with respect to the wall of the cavity. When the head is in this position, the cutting edge of the tool can contact walls and bottom of the cavity.

The work is set up on the machine table or in a vise with the edge of the cavity parallel to the edge of the table. Then the tool is set so it just touches the bottom of the cavity and also the front wall. The longitudinal feed is used to make the first cut into the corner. Next, the cross feed is used to make the second cut. The machine table is lowered to make the third cut, which completes the corner. Rotating the work and making the same sequence of cuts for each corner complete the cavity. If desired, the head can be reset instead of moving the work. With an accurately ground tool bit and care in taking the cuts, extremely small radii can be machined.

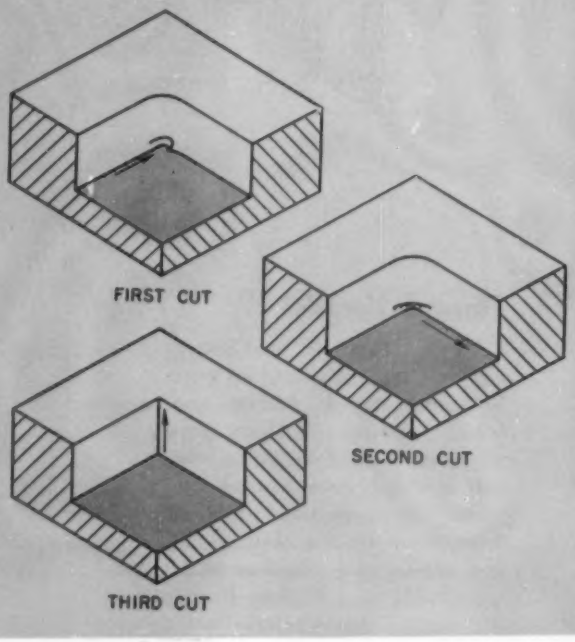
Clint McLaughlin
Rockaway Beach, N. Y.



RECESS CUTTING SETUP--SIDE VIEW

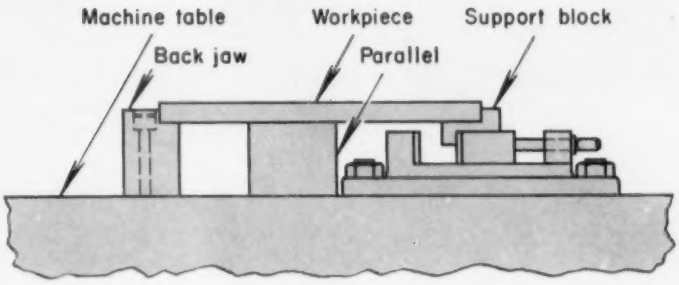


RECESS CUTTING SETUP--FRONT VIEW



Gadgets

Back Jaw for Milling

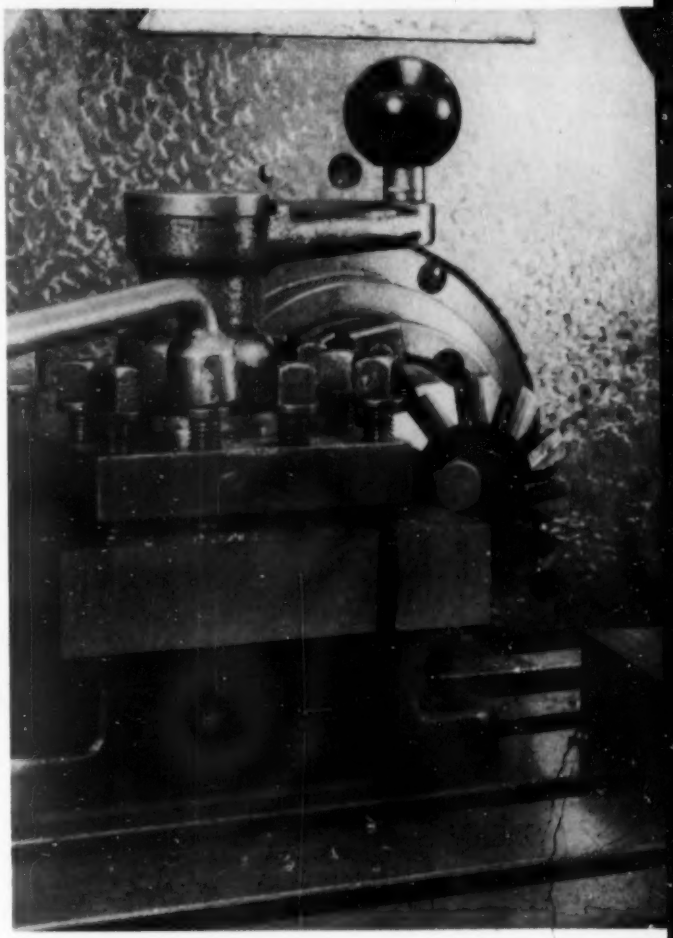


In toolroom milling and boring operations, most workpieces are held in machine vises. Occasionally a workpiece such as a die block or stripper plate will exceed the capacity of a vise. The usual procedure in such cases is to remove the vise and strap the workpiece to the machine table. To avoid this time-consuming procedure, a back jaw can be used.

The back jaw is a steel block with a shoulder to support the workpiece as illustrated. It is secured to the machine table with T-bolts. Another block fits onto the moving jaw of the vise to support the other end of the workpiece. This block can be screwed to the vise jaw; however, it need not be attached for most operations. A set of parallels that can be slipped between the workpiece and the machine table is useful to provide greater support for long workpieces. Experience has shown that back jaws are a real timesaver in the shop.

Ernest Jones
Bronx, N. Y.

Tool Post Milling Fixture



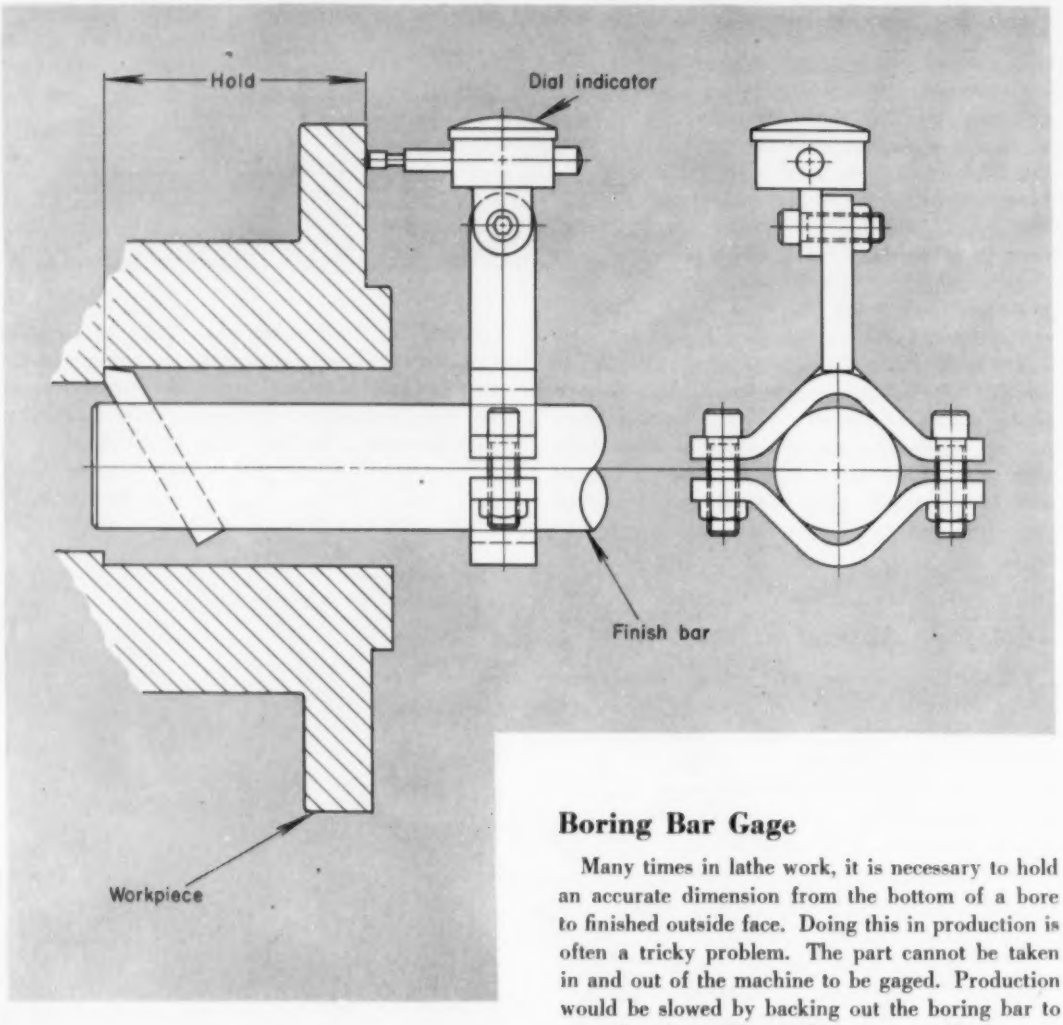
For certain production jobs a heavy-duty square tool post from a turret lathe can be used as a milling fixture. The application illustrated is a simple one, involving the face milling of square section steel bar stock. A side surface of one piece and one end surface of an adjacent piece are being face milled simultaneously.

Considerable time savings are possible with this arrangement as the operator can be engaged in loading and unloading operations on idle stations of the fixture while milling is in progress on the opposite side of the turret. At the completion of each pass, the turret is indexed to the next station to immediately resume machining without lost time. In many cases the table need not be returned to starting position but can simply be reversed in direction of feed for the next cut.

This tooling method has been so successful that it is planned to adapt it to several jobs involving the facing of small castings of various shapes. Each station of the turret will be equipped with a small fixture to properly grip and position the castings. These fixtures will be equipped with fast acting clamps to grip the castings and further increase the efficiency of the tool. This ready-made and accurate indexing unit can be used as the basis for the development of economical fixtures for many types of end milling operations.

H. J. Gerber
Member-at-Large

Gadgets



Boring Bar Gage

Many times in lathe work, it is necessary to hold an accurate dimension from the bottom of a bore to finished outside face. Doing this in production is often a tricky problem. The part cannot be taken in and out of the machine to be gaged. Production would be slowed by backing out the boring bar to gage the piece. The machine stops might be sufficient if part tolerances are great enough; however, where a high degree of accuracy is required a more positive arangement is necessary.

Illustrated is a simply made setting gage that is detachable and can be used on various jobs of a like nature. Two identical steel straps are bent into the form of a vee as shown. On top of one vee an arm is welded to receive a standard dial indicator. In use, the distance from the end of the boring bar cutting tool to the indicator is the same as the part dimension minus one revolution of the dial. When the indicator point touches the work and the needle reaches zero, the operator knows that he has his dimension exactly.

Roger Isetts
Kenosha, Wisconsin

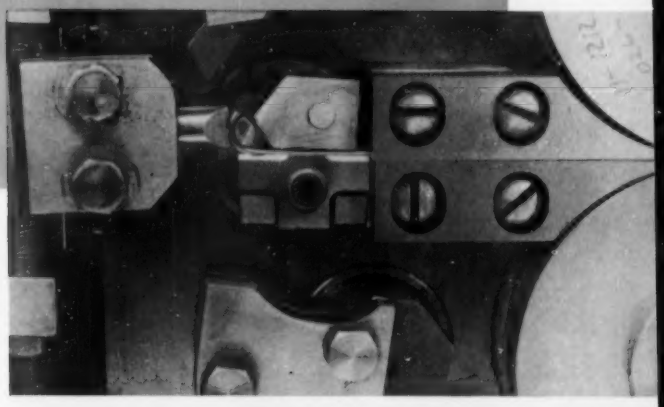
Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Honorariums for accepted articles are sent upon publication.

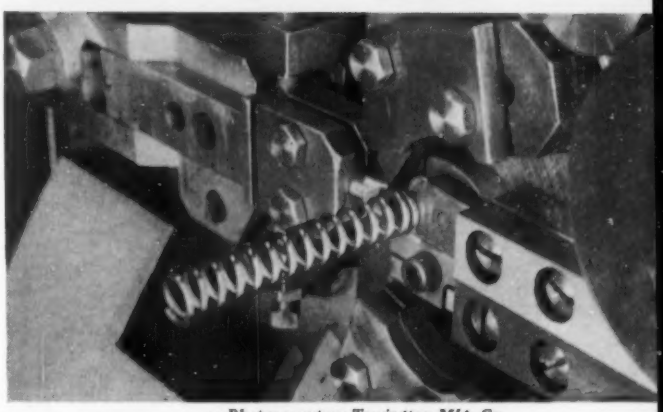
spring manufacture

. . . control minimizes costs

By Sylvester T. Tafelski*
Consulting Engineer
Southfield Engineering Service
Birmingham, Mich.

Manufacture of springs involves a combination of many processes. All operations from the initial forming of the wire to the final heat treatment must remain under constant observation to obtain a quality spring. The author points out how improved methods reduce costs and make a better product.





—Photos courtesy Torrington Mfg. Co.

Fig. 1. Spring coiling operation (top) with the wire fed into the starting position by the forming tool. Completed spring (bottom) with cutoff tool in cutting position during machine cycle.

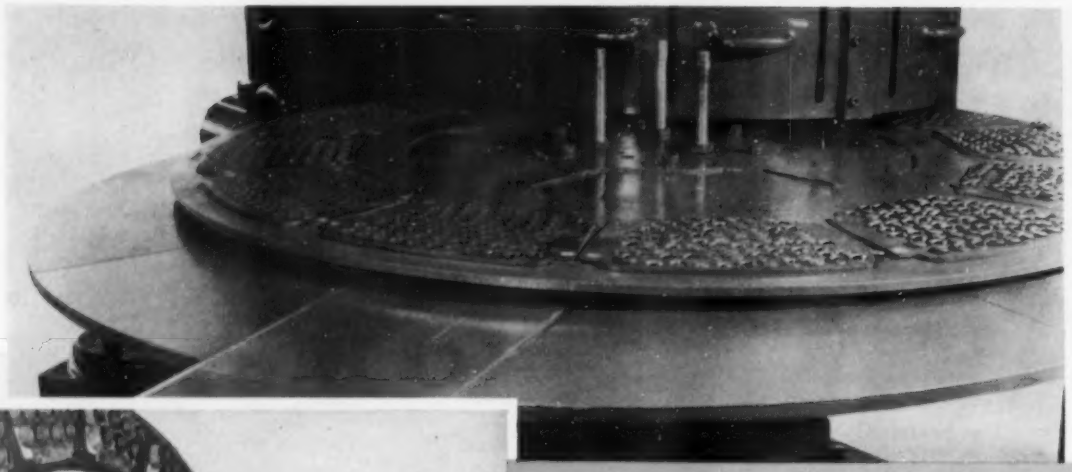
QUALITY CONTROL, as well as good manufacturing methods is important in all phases of spring manufacture. Continuous surveillance of operations is necessary to produce mechanical springs, *Fig.* 1, that meet the critical specifications of industry for these products.

Wire is the raw material for most spring making but is a difficult item to control. When received, a sample is cut from the end of the wire coil and sent to the laboratory for analysis. Tests of the sample include etching, Magnifluxing, tensile testing and chemical analysis as well as macroanalysis.

Process Control: During manufacturing, control of product quality depends on the operator and roving inspectors. In most cases, the inspection checks include a coil diameter measurement by micrometer and spring length by height gage. Consistent quality is often difficult to obtain with this sample checking when a coiling machine is producing springs at a rate of 100 or more parts a minute.

To correct some of the drawbacks of sample inspection, an electronic device is being employed to sort springs for length automatically into three groups, long, short and correct parts. Controls relieve the operator of the responsibility for adjustments of the spring-forming machine when correction is needed. Photoelectric tubes indicate if the spring is too short or too long. Corrective adjustments to the coiling machine are made automatical-

*Senior member ASTE Detroit chapter.



—Photo courtesy Gardner Machine Co.

Fig. 2. (above) Horizontal grinder for squaring spring ends. Parts are automatically ejected through the chute on the front of the machine.

—Photo courtesy Besley-Welles Corp.

Fig. 3. (left) Vertical spindle dry grinder with an oscillating eccentric rotary fixture. Springs are ground at a rate of 4250 springs per hour removing 0.125-inch stock.

ly. Along with the length control, the unit is easily designed for diameter size control correction. Automatic equipment of this type actually finds any spots in a coil of wire that deviate from specification. Since springs must be coiled relative to the correct diameter, pitch and length, those coiled from defective material are usually rejected. However, when these defective springs are being produced, the unit will readjust to compensate for the incorrect dimensions. During this readjustment, a few bad parts will be produced before the machine again produces good parts. This loss of production is negligible when the effects of one bad spring in a product are considered relative to the finished item.

Stress Relief: After coiling, most springs must be heated to reduce stresses developed during the coiling operation. Heat treatment to reduce these work-hardening stresses are based on the type of wire, the wire diameter and the pitch of the spring.

In the spring industry, the usual practice is to collect the springs in containers from the coiling equipment for transferring to the heat-treat furnaces. Furnaces for the stress-relieve operation are either gas fired or electric. In the gas-fired operation, the furnaces have a 45-minute cycle to permit the spring to remain at the required temperature for 20 to 25 minutes. The balance of the cycle is needed to get the part into and out of the heating zone.

Electric furnaces used for this operation are either resistance-rod or infrared-lamp types. The resistance unit is an atmospheric tank type portable oven. Usually a few hours are required to preheat the furnace to reach operating temperature.

In the infrared-lamp furnace, the springs being stress relieved are brought to temperature rapidly because of the concentration of the infrared rays on the springs. Being portable and compact, it is possible to have the oven moved to the coiler so the springs can be fed into it directly without needing to transport them to a special heat-treat area.

Since the springs are subjected to the proper temperatures more quickly, stress relief time can be reduced as much as 50 percent. In one plant, automotive valve springs require only 10 minutes heating at 750 F. Another example can be found in the bed-spring industry where springs are infrared heated only one minute at 500 F. As a result, better concentricity and straightness of the bed springs

were obtained when compared with parts processed by the former method of heating. To assure quality in this operation, the springs must be uniformly heated at the proper temperature to retain the desired characteristics in the final product.

Sizing Operations: Grinding is used to obtain the desired free length of spring and to square the ends. When coiled too long, springs can be ground to length usually without changing the load characteristics of the part, provided the pitch is correct.

Using a horizontal grinder, *Fig.* 2, for this operation, springs are manually loaded into a circular plate. The plate passes between two grinding wheels which grind both ends of the spring simultaneously. After grinding, the springs are ejected through the holes, by gravity, into containers placed beneath the horizontal table of the machine. Vertical grinders, *Fig.* 3, require manual load and unload. Spot checks of the springs are made on the length with a gage. Operations of this type are improved with an automatic wheel dresser and controls to automatically readjust the machine to maintain the correct free length. In addition, automatic or magazine loaders are helpful on types of springs that do not tangle.

Tumbling, as shown in *Fig.* 4, follows the grinding operation on most springs to remove burrs caused by grinding. However, this operation can cause stresses to be built up in the springs if improper tumbling media are used or if the springs are tumbled too long. Whenever this condition occurs, another stress-relieve operation is necessary.

Tumbling is a time-consuming operation that is necessary for making quality springs. However, time can be reduced by using high-quality media and locating the tumbling equipment properly. Good in-process storage also helps to decrease the time spent on this operation. Overhead storage facilities can handle a large variety of springs and save floor space. Springs can be fed to the tumbling barrels by chute. Mounting the tumbling equipment a few feet above the floor permits easier dumping of finished springs into containers. When tumbling is the final operation, the springs are dumped into cartons, weighed and moved directly to shipping or storage.

Shot peening usually increases the life of the spring by improving the surface. This is especially true of valve springs. Stress relief is always necessary after this operation and usually consists of a bluing operation with a heat of from 350 to 400 F.

Heat Setting: This operation consists of manually loading the springs over rods and compressing them in an air press. When compressed solid, the springs are locked in position by means of a collar and setscrew. Heating of the assembled unit is done in a furnace at 750-800 F.

Mechanical loaders have been devised to speed up this operation. If the springs will not tangle, vibratory hoppers are used to orient the springs to the proper feed position. They are then fed through tubular chutes onto the pressing rods. Using this method, it is possible to load as many as four rods at a time.

Small delicate compression springs are heat set between plates in a sandwich arrangement. The center plate has a number of drilled holes which are slightly larger than the diameter of the springs. The thickness of this plate is governed by the free length requirements of the spring. Springs are manually loaded into the holes of the center plate. The two outer plates are then placed in position to complete the sandwich and then all three plates are bolted together for transfer to the furnace.

Flat springs such as Belleville washers also require heat setting. The process is similar in that the springs must be set to the desired shape or height. However, the method differs in that the springs are placed on dies or heating irons made to the contour of the finished part. The loaded irons are then placed in an air-operated press which contains heating elements in both the upper and lower platens. The parts are pressed to the correct shape while heat is applied. The length of time required varies with the spring requirements and the type of steel as well as being based on some experimentation. In

—*Photo courtesy American Wheelabrator Corp.*

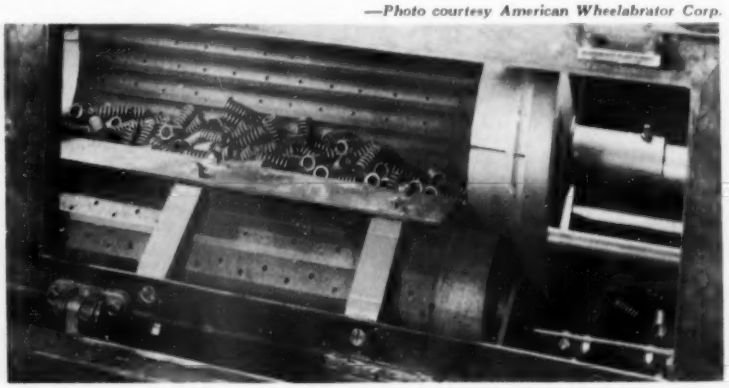


Fig. 4. Continuous tumbling operation on springs. Parts and media feed into the machine from the left and emerge at the right where springs and media are separated.

some cases four or five parts can be stacked one on top of the other on the heat setting iron and then placed in the press.

The aircraft industry performs similar operations in the heat forming of small magnesium formed parts. These parts are loaded in a large press. Large quantities and a variety of parts are loaded to obtain volume production on each press stroke. Heat-setting time for flat springs ranges from 1 to 15 minutes. Since tonnage is a vital factor, more production and better quality result with the use of a larger press for this operation.

End Forming: Looping or putting the hooks on the ends of coiled springs is done either before or after heat treat, depending upon the type of wire used. On short-run production, this work is usually done in a small kick press. Dies for these presses are simple and economical to produce. Volume production requires mechanical presses with press size

——Photo courtesy Toledo Scale Corp.

Fig. 5. Weight testing of valve springs to determine the strength of the finished parts. Operator observes results on scale at the rear of the test stand.

determined by the wire gage. Most of the dies used in these presses are cam type. Looping machines designed especially for these operations are made by the makers of spring coiling machinery. They are useful for volume production.

Recently, attempts have been made to develop looping equipment attached to the spring coiling machine. To date, none of this equipment has proved successful. However, one company that makes springs for use in its own products has a solution. Instead of attempting to loop springs on the coiling machine, the springs drop off into a chute where they are carried to a specially designed looping machine located in front of the coiling machine. Labor and material handlings are both reduced as a result.

Looping machines and presses should be located as close to the coiling department as possible to save handling. The looping operation is slower than coiling and storage, preferably overhead, should be provided for this station.

Finishing Operations: Most springs are either painted or plated. Clean material is important for both operations. In the painting operation, the parts are dipped and the excess paint is spun from the springs. Usually, the painted springs are oven-dryed to increase production.

If a spring is to be plated, care during all processing operations is important. There is always a possibility that springs will be placed in containers while still moist. Since rust accounts for a lot of spring failure, it should be prevented at the source. Some manufacturers use a large gas-fired hot plate on which to dry the springs. It is much simpler to use a stream of hot air with a shaker or vibrator.

Both the paint and plating departments should use the best in-process storage facilities they can procure. A system of overhead conveyors or similar overhead storage proves valuable in solving storage problems in these departments.

Scale or weight testing is a necessary operation on some springs. Most companies have made progress in controlling quality during manufacture and need only sample scale testing. Weight testing is the number of pounds required to deflect a spring a given dimension according to the size of the spring. Proper coiling, heat treat and grinding have eliminated the necessity for most weight test operations.

Valve springs, however, usually require a 100 percent scale test as shown in *Fig.* 5. Because the volume of these springs is high, many types of weight-testing machines have been developed. Some are of the load-cell type coupled to dial index tables or to in-line transfer index equipment. Others incorporate a setting station prior to the weight-test station to increase production.

One scale had a dial index table, a setting station and a weight-test station mounted on it and will also automatically sort springs into three categories such as good, weak or strong. This same scale is used with an electronic device which will not only sort the springs but will signal with lamps to indicate the category. This unit reduces operator fatigue since the lamps are mounted at eye level and the operator does not have to watch the dial of the scale to determine the spring condition.

After the weight test, the springs are usually spot checked in the final inspection department. Efficient plant layout combined with an effective quality-control program are necessary to manufacture springs economically. Progressive management is always searching for new and better methods of manufacture and higher quality.

safety devices prevent die breakdowns

By Federico Strasser
Santiago, Chile

Press and die breakdowns due to overloads can be avoided by incorporating mechanical safety elements into dies. These devices protect equipment against damage when an overload is applied.

MECHANICAL OVERLOADS are a frequent cause of press and die breakdowns. Such breakdowns are expensive, not only because of the cost of repair parts and maintenance time, but also because of the loss of productive capacity.

Most overloads result in broken die plates. It is impossible to prevent all overloads because there are so many possible causes. The work material may be too hard or too thick. The strip may be too wide or too narrow. Dull punches may fail to penetrate the material, resulting in broken punches and sometimes in broken die plates. Careless die setting or press vibrations may cause tool misalignment. A press operator may insert two blanks or strips in a die simultaneously, overloading the die. Too-large blanks in second-operation forming dies sometimes cause die breakage. Failure of an ejection mechanism to remove a completed stamping is an added source of difficulty.

Consequently, the use of overload protection devices is almost mandatory, particularly when expensive dies are used. These devices intervene during overload conditions so that the operation is stopped before damage to press or die results. They can be connected either to the die or to the press itself. Shear plates, shear pins, hydraulic pitmans and the like are examples of mechanical protective devices. Electrical (and electronic) protective devices are also used. These include controls for the press driving motor and precision limit switches that control certain tool members. This article deals with mechanical devices only.

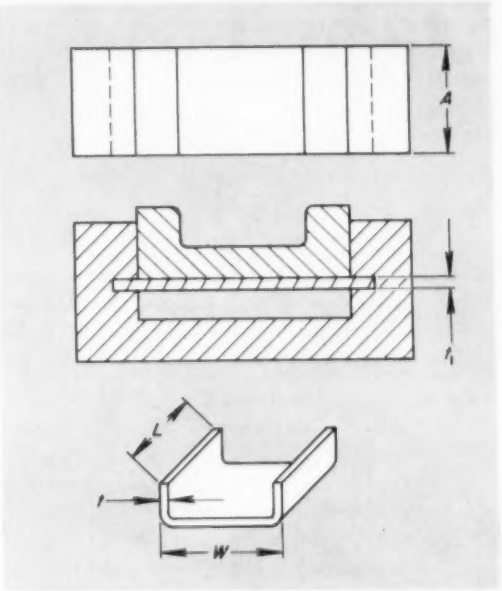


Fig. 1. Bending die equipped with safety plate. Plate breaks when excessive force is applied, preventing that force from being transmitted to the die.

Most mechanical safety elements are designed to break when a certain load is reached, thus preventing a heavier overload from causing damage to the die or press. Safety elements can be installed in the die holder, the punch holder, or in the punch shank. The elements usually consist of steel plates for die or punch holder applications; for punch shank applications, round stock is preferred. In all cases, the safety element is designed so that it is easily replaceable. Generally, the safety element is strong enough to resist the normal load, plus a 25 to 30 percent overload, before shearing. Hard materials are best because they require less shear penetration before they are sheared through.

A typical safety element is shown in *Fig.* 1. It is

used in the female portion of a channel bending die. The bending pressure for a U-shape is calculated by the formula:

$$F = 2\left(\frac{1.33\ LSt^2}{W}\right)$$

where L is length of bend, inches; S is the ultimate strength of the stock to be bent, psi; t is stock thickness, inches; and W is width of channel, inches. Strength of the safety plate is calculated as follows:

$$R = 2(AS_1t_1)$$

where A is the length of shearing line, inches; S_1 is the shearing strength of the material employed for the plate, psi; and t_1 is the thickness of the plate material. For this application, $R = 1.30F$. Thus:

$$2AS_1t_1 = (1.30)2\left(\frac{1.33\ LSt^2}{W}\right)$$

$$t_1 = \frac{(1.30)2(1.33\ LSt^2)}{2AS_1W}$$

$$= \frac{1.73\ LSt^2}{AS_1W}$$

In an actual case, the following data were available: $L = 2$ inches; $W = 2.5$ inches; S (mild steel sheet) = 50,000 psi; $t = 0.1$ inch; $A = 2.5$ inches and S_1 (high-strength steel sheet) = 90,000 psi. Substituting:

$$t_1 = \frac{(1.73)2(50{,}000)(0.1)^2}{(2.5)(90{,}000)(2.5)} = 0.0485$$

A drawing punch designed with a safety element is shown in *Fig.* 2. Maximum drawing pressure is usually calculated by the formula: $F_1 = \pi Dt_2S$, where D is the mean diameter of the drawn shell in inches. The strength of a round safety plate is: $R_1 = \pi D_1t_3S_1$, where D_1 is the diameter of the punch in inches. Also, for this application, $R_1 = 1.30F_1$; i.e., $\pi D_1t_3S_1 = 1.3\ \pi Dt_2\ S$. Thus:

$$t_3 = 1.3\left(\frac{\pi Dt_2S}{\pi D_1S_1}\right)$$

$$= 1.3\left(\frac{Dt_2S}{D_1S_1}\right)$$

Taking an actual example, $D = 3$ inches; $t_2 = 0.05$ inch; S (brass sheet) = 40,000 psi; $D_1 = 3.5$ inches; and $S_1 = 90{,}000$ psi. Substituting these figures in the equation:

$$t_3 = 1.3\left(\frac{(3)(0.05)(40{,}000)}{(3.5)(90{,}000)}\right) = 0.248$$

For blanking dies, pins, rather than plates, are generally used for overload protection. The pins are inserted in hardened bushings as shown in *Fig.* 3.

Blanking force is calculated using the formula: $F_3 = LtS_2$, where L is the length of the cutting contour, inches; t is stock thickness, inch; and S_2 is the shearing strength of the stock to be blanked, psi. The strength of a round pin is calculated:

$$R_2 = 2\left(\frac{\pi d^2}{4}\right)S_1$$

where d is the pin diameter in inches and S_1 is the shearing strength of the pin material, psi. The desired pin strength, R_2, is $1.30F_3$.

In order to avoid the necessity of employing large-diameter dowel pins, a number of smaller pins are employed. Where n is the number of pins:

$$2n\left(\frac{\pi d^2}{4}\right)S_1 = 1.3LtS_2$$

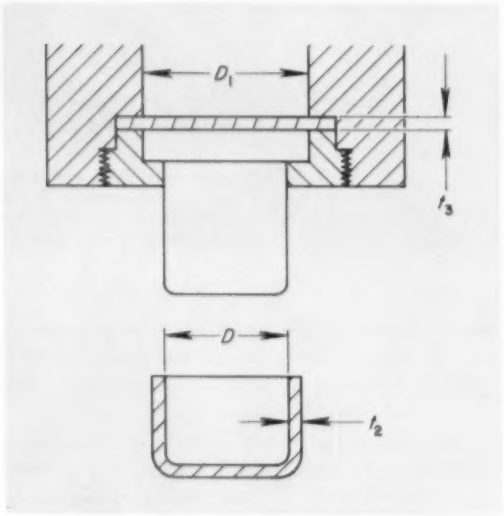
$$d^2 = \frac{4(1.3LtS_2)}{2n\pi S_1}$$

$$d = \sqrt{0.83\left(\frac{LtS_2}{nS_1}\right)}$$

The following data were used in calculating pin diameters for a production drawing die: $L = 7$ inches; $t = 0.1$ inch; S_2 (Monel metal) = 65,000 *psi;* S_1 (drill rod) = 80,000 psi; and $n = 3$. Applying these figures to the equation:

$$d = \sqrt{\frac{0.83(7)(0.1)(65{,}000)}{3(80{,}000)}} = 0.4$$

These theoretical calculations should always be checked by experiment in order to eliminate any possible damage from overloads in production stamping operations.



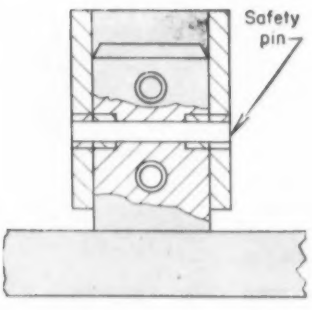


Fig. 2. (above) **Punch of drawing die is held in position with safety plate.**

Fig. 3. (left) **Method of installing safety pins in blanking punch shank.**

CUT 75 percent FASTER ...with powder metal shanks

By Horace A. Frommelt
Director
Metal Removal Center
Spring Garden Institute
Philadelphia, Pa.

Tests show that the vibration-dampening effect of powder-metal shanks permits 35 to 75 percent increases in cutting speeds with improved part finish. The author describes test results and shows that wear land, longitudinal cutting force and vibration are definitely interrelated. Thus measurement of increases in vibration is a good method of checking tool wear in machinability tests.

FOR MANY YEARS, steel has been the standard material for cutting tool holders. With the advent of the harder carbides and ceramics, which tend to chip and crack under vibration, substitutes for the highly elastic steel materials have been studied. Solid carbides, with their high Young's modulus, are obviously a good solution, technically speaking. Because of their high cost, however, carbide shanks are not used, except for special applications. Solid carbide boring bars and cored carbide bars, for example, have demonstrated sizeable increases in tool life and their use may be economically sound.

Several other shank materials have also been tried out. Shanks of the so-called "heavy metals," produced by powder metallurgy techniques, give excellent results but are costly. Molybdenum has also been proposed as a shank material. Tests conducted with molybdenum have demonstrated the advantages of holders that dampen vibration, but high cost has prevented extensive application.

Copper-impregnated powder-metal shanks appear to offer the best combination of vibration-dampening effect and low cost. Straight iron powders are used, compressed to a density of 6.0. Considerable work has been done on the optimum composition of such shank materials. In general, there is necessarily a compromise between strength and dampening qualities. Shanks with low density and high copper content have best dampening qualities but poorest strength. Straight iron powder, pressed at 30 tons per square inch after sintering, has a tensile strength of 30,000 psi. After copper infiltration, this strength is raised to as high as 80,000 psi, which is satisfactory for shank applications.

Machining Tests: In order to determine the effect of these powder-metal shanks on tool life, a series of tests were run. The shanks used for test purposes varied in tensile strength from 70,000 to 85,000 psi. Even under severe load conditions, there were no shank failures. During the tests, optimum or near-optimum dampening of vibrations occurred.

This dampening characteristic of the material is not dependent on its Young's modulus, which is one-third that of steel. Dampening is due to the fact that the material is composed of discrete particles, held together in the copper matrix.

A comparison between the dampening effect of steel and powder-metal shanks is shown in the ac-

Abstracted from Paper 193, "A New Approach to Machinability Determinations," presented at the 27th Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

companyng table. Vibration recordings, made with a transducer or pickup, indicate a dampening effect even when the shank is not taking a cut. An even greater reduction in vibration is noted when the tool is engaged in the work.

When cutting at 600 fpm, 0.125-inch depth of cut and 0.0008 ipr feed, the reduction in vibration varies from 35 to 55 percent. When the depth of cut is increased to 0.062 inch, the reduction in vibration is almost 75 percent. A 1045 steel was used for both tests.

The dampening effect of powder-metal shanks is especially significant when making interrupted cuts. Cutting 1045 steel at 400 fpm and a 0.050-inch depth of cut, with ¼-inch diameter holes spaced 1½ inches apart on the circumference of the workpiece, the reduction in vibration was 50 percent. Reduced vibration makes possible longer tool life when cutting at the same rate of speed, or the same tool life when cutting at higher speeds. Also, surface finishes are improved.

Boring bars of the same iron-copper composition were also tested. These bars give better results than steel bars, particularly with large unsupported extensions such as are common in boring. In some instances, both in tests and in production, use of powder-metal bars made it possible to successfully apply ceramic cutting tools for operations where ceramics previously gave poor results. It is possible to re-enter a ceramic tool ten times with a powder metal shank and bar, as compared to two times for the same tool used in a steel shank. The results are plotted in the accompanying figure.

In one case, a 4340 material, heat treated to a 45 R_c hardness, was bored with ceramics and a powder-metal bar. Ceramics were the only possible cutting tool material for this operation, which was previously performed by grinding. The grinding operation took two hours, while the boring operation took one minute. Solid carbide or cored carbide boring bars, or bars made of the "heavy metals" would give equally satisfactory results, but the powder-metal bar provides equally satisfactory dampening at much lower initial cost.

Machinability Determinations: The tests with powder-metal shanks definitely indicate that there is a relationship between vibration and tool life. At a given cutting speed, a tool in a vibration-dampening shank will have much longer life than a tool in a conventional steel shank. An increase in vibration indicates tool wear and can, in fact, be used to check tool wear in machinability studies.

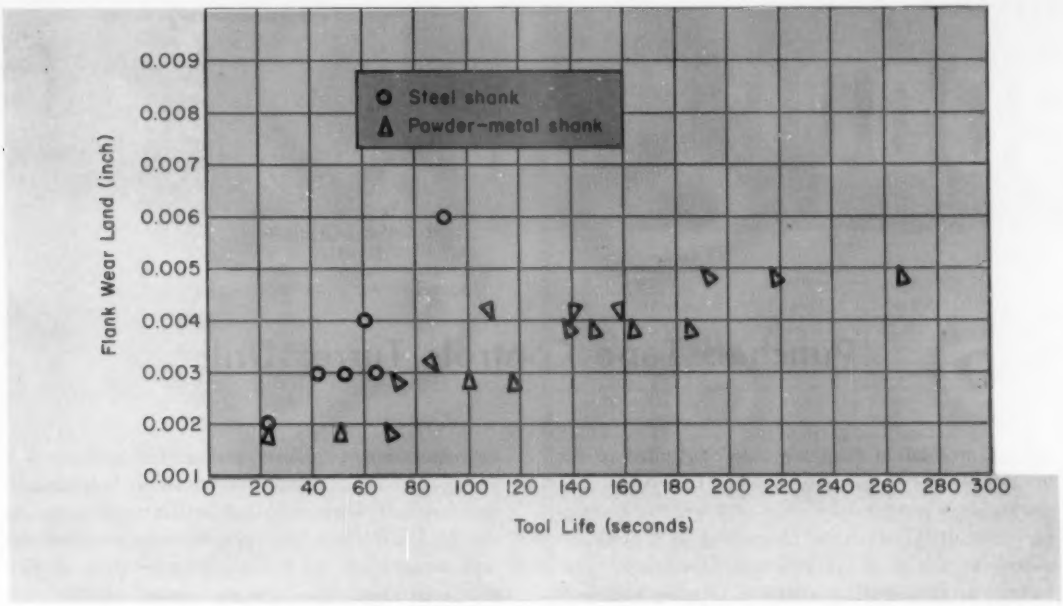
Several methods of checking tool wear are in current use. Perhaps the most frequent is the measurement of the so-called wear land in thousandths of an inch. Another is the increase in the longitudinal force with decreasing edge sharpness of the cutting element. A third is the increase in vbrations with increase in the wear land.

Wear land, increase in cutting force and increase in vibrations have been correlated. A definite relationship exists between these three phenomena. Use of wear land as a means of checking tool life is not fully satisfactory, since it is impossible to precisely determine the relationship between elapsed time and

Vibration of Single-Point Toolholders

Test No.	Shank Material	Depth of Cut (inch)	Feed (ipr)	Speed (fpm)	Test Bar No.	Bar Diam (inches)	Machine Vibration (mils)	Cutting Tool Vibration (mils)	Actual Tool Vibration (mils)	Vibration Decrease (percent)
1	P. M.	0.125	0.008	600	1	2.375	0.03	0.16	0.13	35
1-A	Steel	0.125	0.008	600	1	2.375	0.05	0.25	0.20	
2	P. M.	0.125	0.008	600	1	2.375	0.02	0.10	0.08	55
2-A	Steel	0.125	0.008	600	1	2.375	0.05	0.23	0.18	
3	P. M.	0.125	0.008	600	1	2.093	0.03	0.40	0.37	36
3-A	Steel	0.125	0.008	600	1	2.093	0.04	0.60	0.56	
5	P. M.	0.062	0.008	400	2	2.00	0.015	0.02	0.005	75
5-A	Steel	0.062	0.008	400	2	2.00	0.02	0.04	0.02	
6	P. M.	0.062	0.008	400	2	1.860	0.02	0.025	0.005	75
6-A	Steel	0.062	0.008	400	2	1.860	0.03	0.05	0.02	
7	P. M.	0.050	0.008	400	3*	1.593	0.08	4.0	3.92	50
7-A	Steel	0.050	0.008	400	3	1.593	0.10	7.0	6.90	
8	P. M.	0.050	0.008	400	3	1.493	0.09	3.4	3.31	50
8-A	Steel	0.050	0.008	400	3	1.493	0.12	6.5	6.3	
9	P. M.	0.050	0.008	400	3	1.393	0.10	3.8	3.70	50
9-A	Steel	0.050	0.008	400	3	1.393	0.13	7.0	6.87	

*Perforated bar. Readings taken when tool entered perforations.



Comparison between tool life with steel shanks and powder-metal shanks. VR-97 ceramic tools; speed, 1100 fpm; feed, 0.010 ipr; depth of cut, 0.050 inch. Material is 4340 steel, hardened to 200 Bhn.

wear land. Thus, if wear land is measured at 0.005 inch, it is impossible to state whether this is the beginning, middle or end of a 0.005-inch wear land plateau. There is no straight-line relationship between time and wear land.

Error is also possible when longitudinal cutting forces are measured. Strain gages used to record these forces are affected by increases in the temperature of the toolholder to which they are attached. Hence, these recordings can be inaccurate. Investigation using vibration as the norm indicates that it may be a more accurate method of checking than either of the other two.

Future Applications: The Taylor formula, $V \times T^n = C$ states the relationship between cutting speed, V; time in cut (tool life) T; and C, cutting speed for a tool life of one minute. The slope of the curve is expressed by the exponent n. The value of C increases when machine or tool vibration decreases. This formula was developed more than 60 years ago. Unfortunately, much of Taylor's work have been forgotten in the intervening years, particularly as it relates to the time a cutting tool should be engaged in removing metal before it is replaced.

From Taylor's formula, this time decreases as cutting speed increases—a significant fact that has been completely ignored, with emphasis being placed on the length of time a tool remains on the job. Instead, concern should be centered on the surface foot rate, since this is the determining factor in the metal removal rate, which in turn determines the economics of machining.

This phase of the economics of machining is usually referred to as "Optimation." Taylor's work was based on a tool life of 20 minutes. With the indexable, precision-ground inserts available today, the "optimated" time should be considerably less than 20 minutes. Actually, optimum tool life on many operations today can be mathematically determined as 10 minutes or under. The high surface foot rates involved in such optimated times can be easily attained with the use of powder-metal shanks and bodies, substantially lowering costs.

Foil-Welding Technique Rockets Savings

Unexpectedly large savings are being accrued by reclamation of scrap metal through a new welding process. To demonstrate its worth, the technique has brought about a $70,000 annual savings on a single automotive stamping at one plant by welding odd-shaped off-fall into usable size sheets. The process, as introduced by Precision Welder and Flexopress Corp., incorporates the Peco foil butt seam welding process familiar to European engineers. Foil welding permits smooth, nonoverlapping seam welds at speeds as high as 24 fpm. With present scrap loss of 30 to 40 percent of all sheet metal used in the automotive industry alone, the process could shortly be producing a tidy savings for alert manufacturers in the field.

designed for

PRODUCTION

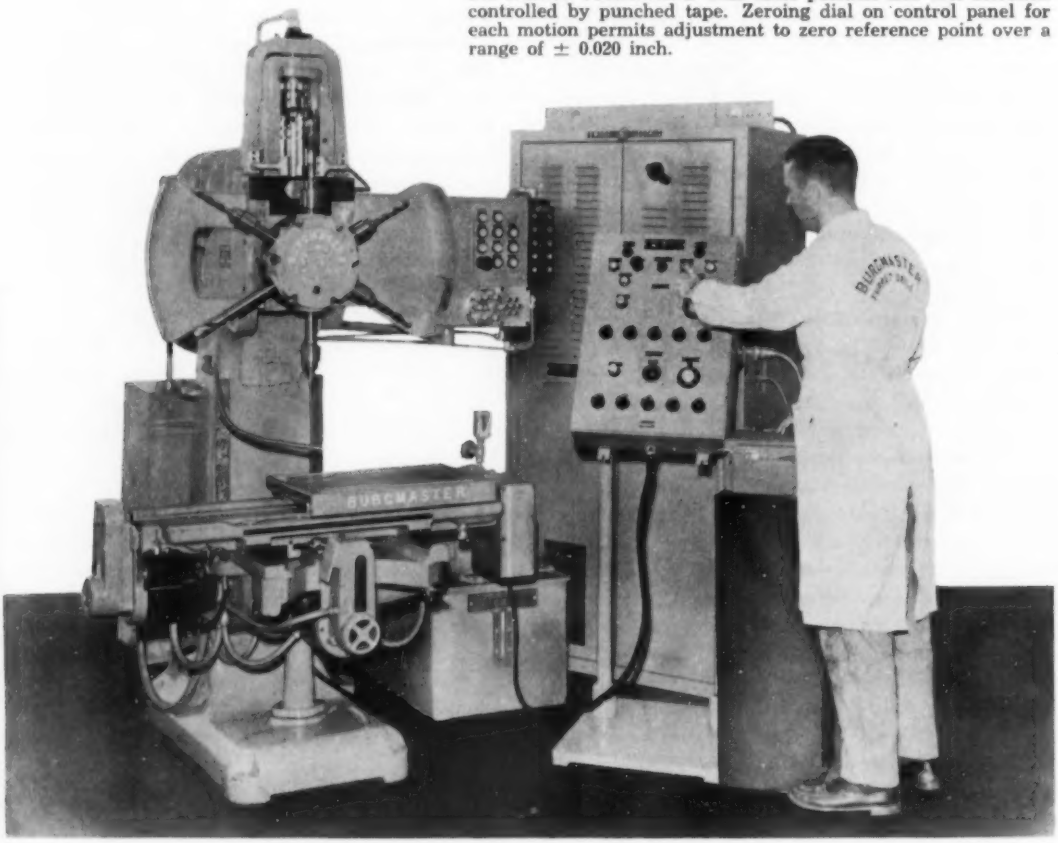
Punched Tape Controls Turret Drill

Short production runs are tape controlled in the Burgmaster-G. E. numerical control system. The worktable is positioned in two axes and the hydraulic turret drill is operated according to a predetermined sequence of operations. Operations may include drilling, boring, reaming, tapping and spotfacing to close tolerances with simple tooling.

When programming a part, the starting position from which all hole locations are referenced is determined. Using the machine spindle speed chart, the operation sequence and turret stations are designated on a program sheet. With hole coordinates, spindle sequences and auxiliary functions on the program sheet, the programmer punches the tape keyed with the correct code for each coordinate hole location on the workpiece.

Standard machine controls on the machine provide preselected spindle speeds ranging from 20 to 3000 rpm. Control can be either manual, dial or automatic tape for the cycling.

SIX-STATION TURRET DRILL with table position and tool selection controlled by punched tape. Zeroing dial on control panel for each motion permits adjustment to zero reference point over a range of ± 0.020 inch.



BURGMASTER G E PROGRAM SHEET PAGE ____ OF ____

PRM ____ PART ____ DWG No ____

DEPT ____ MAT SPEC ____

FIXTURE No ____ BURGMASTER MODEL No ____ 2BHT ____ 3BHT ____

TOOL CHART

TURRET POSITION	OPERATION	SPINDLE SPEED	FEED PER REV
1	CENTER DRILL	3000	.004
2	39/64 DRILL THRU	700	.012
3	BORE .6250/.6250	450	.004
4	.043 DRILL THRU	12000	.001
5	11/16 DRILL THRU	350	.010
6	TOP 3/4-16 CLASS 3	225	.062

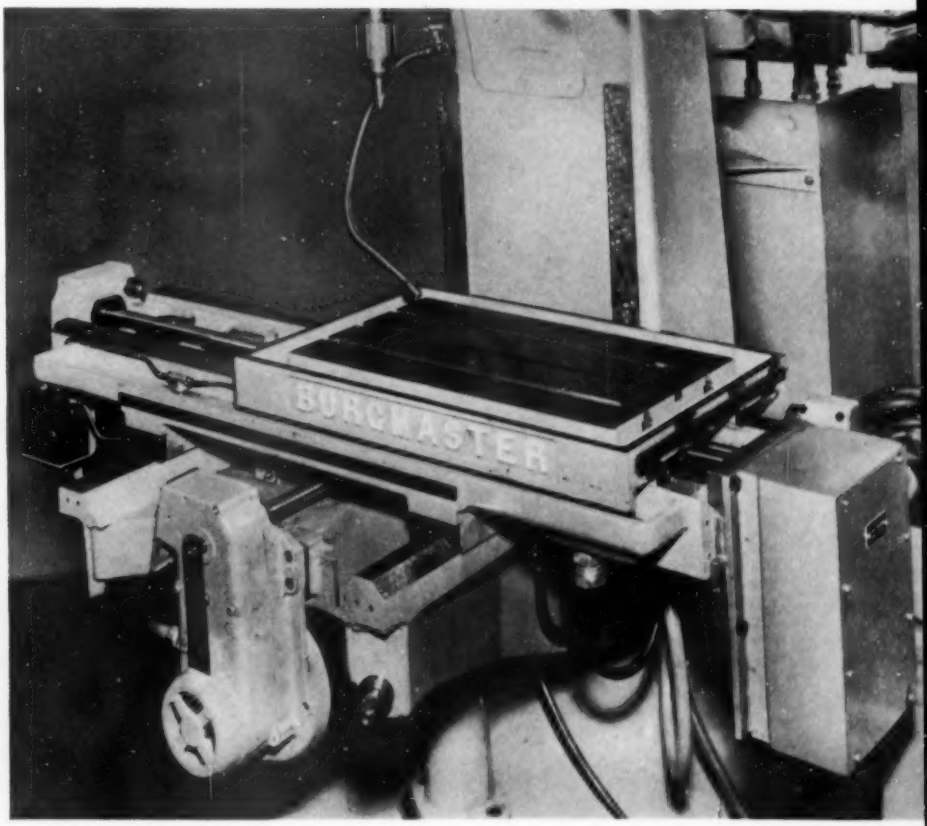
AUXILIARY FUNCTIONS B - Coolant On E - Coolant Off M - Cycle Stop

COORDINATE DATA Starting Position A ____ B ____ For Reference

	A - DIMENSION TABLE	B - DIMENSION Saddle	C - TURRET STATION	AUXILIARY FUNCTION
A	03.156	04.000	1	D-E
B	05.256	08.003	1	E
C	06.261	04.043	1	E
D	10.368	06.396	1	E
D			2	E
D			3	F
C	06.261	04.043	5	E
C			6	F
B	05.256	08.003	4	F

TYPICAL PROGRAM SHEET for a six-position turret drill using a tape-controlled system for determining machine cycle requirements.

Five-pitch ball-bearing lead screws mounted in preloaded ball thrust bearing control each table motion. Attached to one end of each screw is a special d-c motor and a precision position feedback unit is located at the other end. Signals from the control director are amplified and control the Thymotrol output to regulate the speed of the positioning motor. Table positioning speed is 150 ipm. Repeatable electrical accuracy is within ± 0.0005 inch with table positioning accuracy of 0.001 inch.



SERVO FEEDBACK UNIT and d-c positioning motor are connected to lead screws controlling two axes of worktable.

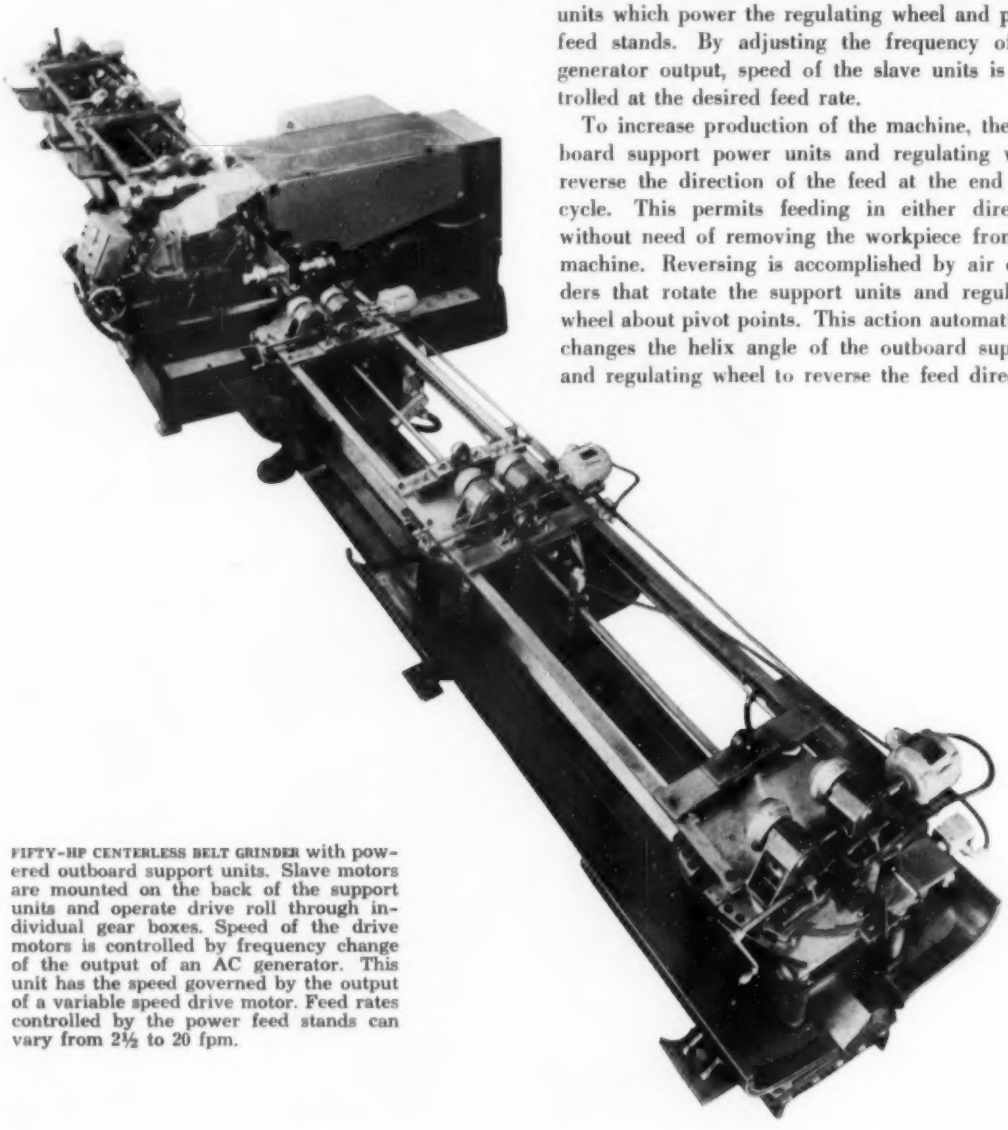
Centerless Belt Grinder for Rapid Material Removal

Heavy single-pass stock removal, fine finishes and close tolerances are possible on a centerless belt grinder developed by Engelberg, Inc. of Syracuse, N. Y. A 50-hp motor drives the 8 by 132 inch belt at 4500 sfm. When processing stainless steel bars, the machine removed about three pounds of metal per minute at a feed rate of 70 ipm during a test.

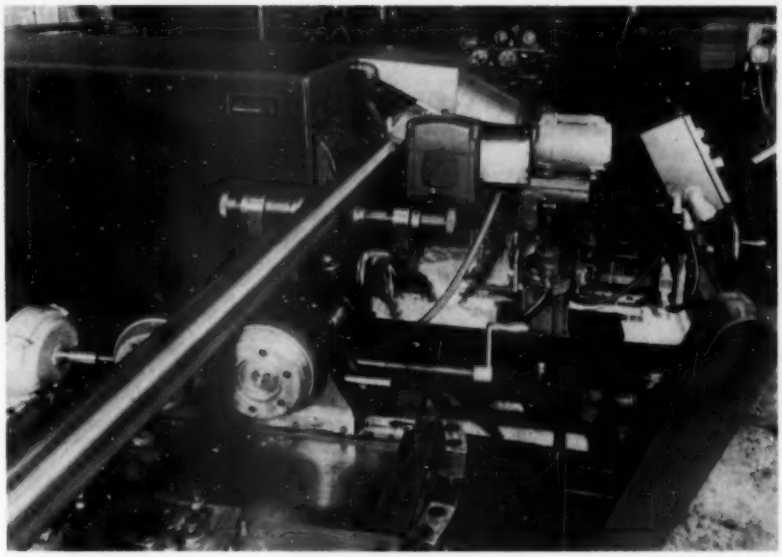
Powered outboard support units, automatic reverse-feed and a power infeed control are features that increase workpiece capacity. The machine will accommodate material from 1 to 9 inches in diameter and any length. Average through-feed rates at a four-deg helix angle setting of the regulating wheel and feed stands vary from 2½ to 20 fpm.

The outboard support mechanism has a main power unit which consists of a 7½-hp variable-speed motor to drive an AC generator. Output from the generator drives seven slave-motor drive units which power the regulating wheel and power feed stands. By adjusting the frequency of the generator output, speed of the slave units is controlled at the desired feed rate.

To increase production of the machine, the outboard support power units and regulating wheel reverse the direction of the feed at the end of a cycle. This permits feeding in either direction without need of removing the workpiece from the machine. Reversing is accomplished by air cylinders that rotate the support units and regulating wheel about pivot points. This action automatically changes the helix angle of the outboard supports and regulating wheel to reverse the feed direction.



FIFTY-HP CENTERLESS BELT GRINDER with powered outboard support units. Slave motors are mounted on the back of the support units and operate drive roll through individual gear boxes. Speed of the drive motors is controlled by frequency change of the output of an AC generator. This unit has the speed governed by the output of a variable speed drive motor. Feed rates controlled by the power feed stands can vary from 2½ to 20 fpm.

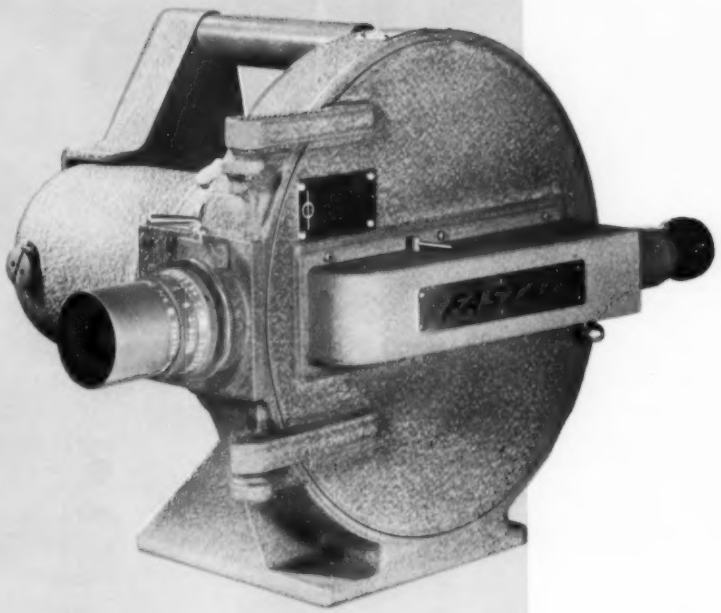


STEEL BAR being centerless belt ground. Powered outboard support unit in the foreground as well as the regulating wheel is rotated eight degrees to reverse the direction of feed at the end of the cycle.

High-Speed Camera Stops Action

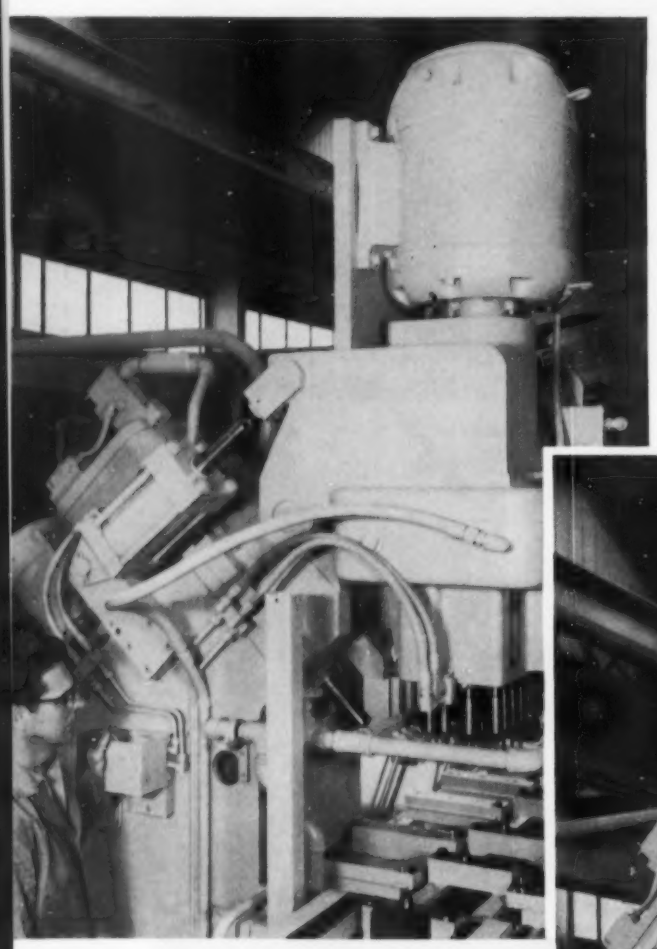
Designed to stop motion too fast for the human eye to see, a motion picture camera, developed by Wollensak Optical Co. of Rochester, N. Y., records action of film so it can be projected later at conventional speed for analysis and study. It has a high-index glass, two-sided prism shutter and special drive mechanism.

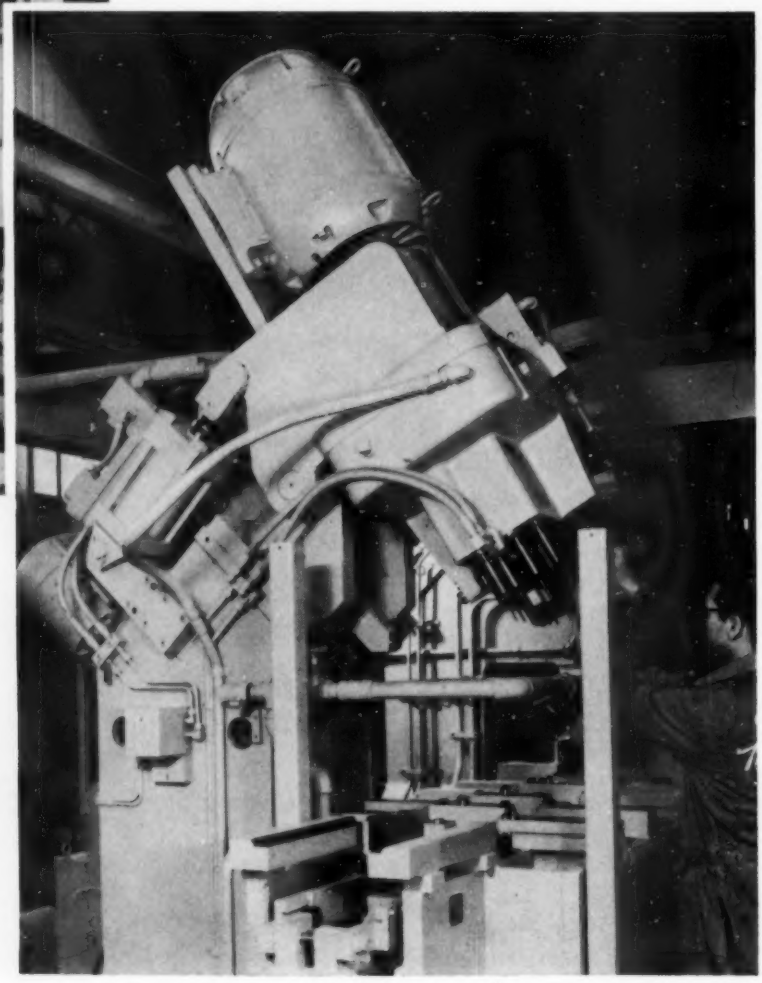
During operation, the continuous rotating two-sided prism is synchronized with film movement to take pictures at rates from 150 to 6000 frames per second. For any given frame rate, effective shutter speed is nearly twice as fast as with four-sided prism cameras.



Swivel Head Facilitates Tool Changes

Changing tools in a station of a transfer line causes a loss of productive machine time. To reduce this lost time, a swivel head has been developed by the Cross Co. of Frazer, Mich. to swing the tools out of the work area. During tool change, the operator actuates a hydraulic cylinder to pivot the head to a position of greater accessibility for replacement of the worn or broken tools. When the change has been completed, the head is returned to the proper position by reversing the cylinder and it is properly located by blocks mounted on the head and column of the machine.





DRILL UNIT (above) in the normal operating position. (right) Unit swiveled during tool change to make tools more accessible during replacement of worn or broken tools.

calculating machine utilization

By Alfred A. Kuebler*

Associate Professor
Industrial Engineering Dept.
Rutgers University
New Brunswick, N. J.

Calculation of optimum number of machines to be used in a multimachine operation commonly requires involved calculations. The author, by means of a simplified equation, reduces calculations and expresses results in tabular form.

MACHINE INTERFERENCE can sharply reduce machine utilization in multimachine operations. By knowing the amount of interference to expect for a given set of conditions, the optimum number of machines can be determined. Machine utilization is the ratio of machine running time to total cycle time. In the case of a man running only one automatic machine, running time is simply the total time minus setup and clearing time. When an operator is running more than one machine, an additional loss of output results from machine interference; that is, an interference of operator servicing demand when more than one machine is idle.

Binomial Expansion: Many mathematical methods have been developed for calculationn of optimum machine number. The most easily understood, though somewhat restrictive in assumptions, is the binomial expansion method. In order to use this method (or any other method) it is necessary to ascertain a standard time for setup and clearing for each specific operation, expressed as a percentage of total cycle time. The percentage values are then substituted in the binomial $(q+p)^n$, and expanded, where q = probability of machine running, p = probability of machine idle, n = total number of machines operator must service.

$$(q+p)^n = q^n + nq^{n-1}\,p + \frac{n(n-1)}{2}\,q^{n-2}\,p^2 + \frac{n(n-1)\,(n-2)}{2\times 3}\,q^{n-3}\,p^3 \ldots . (1)$$

The terms in the binomial will represent the percentage of total time that no machines are idle, one machine is idle, two machines are idle, and so on. Interference occurs when more than one machine is idle. If two machines are idle, one will wait while the other is attended. The expected interference will be given by the number of machines inactive for an additional time, in this case equal to 1, multiplied by the probability of having two machines idle. Since $\frac{n(n-1)}{2}$ can be written $\binom{n}{2}$, the expressions for various conditions can be written:

x machines idle:

$$\left[(x-1) + (x-2) + \ldots . + 1\right]\binom{n}{x}\,q^{n-x}\,p^x$$

All machines idle:

$$\left[(n-1) + (n-2) + \ldots . + 1\right]\binom{n}{n}\,q^n\,p^n$$

Letting EI = expected interference and X = number of machines idle, the sum of all the interferences from 2 to n can be written in the form:

$$EI = \sum_{x=2}^{n}\left[(x-1 + (x-2) + \ldots . + 1\right]\binom{n}{x}p^x\,q^{n-x} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Equation 2 can be simplified as follows:

$$EI = \sum_{x=2}^{n}\left[(x-1) + (x-2) + \ldots . + 1\right]\binom{n}{x}p^x\,q^{n-x}$$

It can be shown that

$$\left[(x-1) + (x-2) + \ldots . + 1\right] = \frac{x(x-1)}{2}$$

*Senior member ASTE Northern New Jersey chapter.

Then

$$EI = \sum_{x=2}^{n} \frac{x(x-1)}{2} \binom{n}{x} p^x q^{n-x}$$

$$EI = \frac{1}{2} \sum_{x=2}^{n} x(x-1) \frac{n!}{x!\ (n-x)!} p^x q^{n-x}$$

$$EI = \frac{1}{2} \sum_{2}^{n} \frac{n!}{(x-2)!\ (n-x)!} p^x q^{n-x}$$

Since

$$n! = (n-2)!\ (n-1)n$$

Machine Utilization

Number of Machines Per Operator	Normal Delay (percent) 10		20		30		40		50	
	EI	*U*	*EI*	*U*	*EI*	*U*	*EI*	*U*	*EI*	*U*
1	0	90.0	0	80.0	0	70.0	0	60.0	0	50.0
2	1	89.5	4	78.0	9	65.5	16	52.0	25	37.5
3	3	89.0	12	76.0	27	61.0	48	44.0	75	25.0
4	6	88.5	24	74.0	54	56.5	96	36.0	150	12.5
5	10	88.0	40	72.0	90	52.0	160	28.0	250	0
6	15	87.5	60	70.0	135	47.5	240	20.0	375	-
7	21	87.0	84	68.0	189	43.0	336	12.0	525	-
8	28	86.5	112	66.0	252	38.5	448	4.0	700	-
9	36	86.0	144	64.0	324	34.0	576	-	900	-
10	45	85.5	180	62.0	405	29.5	720	-	1125	-

Then

$$EI = n(n-1)\ \frac{1}{2} \sum_{2}^{n} \frac{(n-2)!}{(x-2)!\ (n-x)!} p^x q^{n-x}$$

Let $x-2 = y$; $x = y + 2$

$$EI = n(n-1)\ \frac{1}{2} \sum_{0}^{n-2} \frac{(n-2)!}{y!\ (n-y-2)!} p^{y+2} q^{n-y-2}$$

$$EI = \frac{1}{2} n(n-1)\ p^2 \sum_{0}^{n-2} \binom{n-2}{y} p^y q^{n-2-y}$$

Since, for any positive number, m

$$\sum_{0}^{m} \binom{m}{y} p^y q^{m-y} = (p+q)^m = 1$$

Then

$$EI = \frac{1}{2} n(n-1)\ p^2 \qquad (3)$$

Equation 3 eliminates the laborious process of binomial expansion. Using this equation if four machines are used, each having a running time of 90 percent and a normal delay of 10 percent, then $EI = (\frac{1}{2})(4)(3)(0.10)^2 = 0.06$.

This is to say that interference may be expected six percent of the time in this situation. Similarly, when five machines are involved, the expected interference would be ten percent; and if only three machines are used, the interference is three percent.

Machine Utilization: The machine utilization, *U*, can be found by deducting the normal delay time and the interference delay time from the total time, and dividing by total time:

For the case of four machines:

$$U = \frac{4.00 - 0.40 - 0.06}{4.00} = 88.5 \text{ percent}$$

These values of expected interference and utilization may be expressed in tabular form as shown in the accompanying table. Care must be taken in the application of this method and the user be cognizant of the following restrictions:

1. Accurate values of running time and normal delay must first be established, since obviously, results will be no more accurate than initial data.
2. Operation studied must be homogeneous; only identical machines doing identical work may be used in a single study
3. Operator must be continuously and immediately available to service machines
4. No random machine service or repair time is allowed other than that allowed for in normal delay, unless such time has previously been determined and is included in normal delay.

Establishing Delay: Normal delay may be obtained through time study or by use of ratio delay or work-sampling techniques. In this method, a large number of observations are taken at random intervals, recording whether or not a machine is operating. To employ this method satisfactorily the following precautions must be observed:

1. A truly random time of observation must be used
2. Operators must carry on in a completely normal manner
3. The observer must not anticipate observations, but must record them instantaneously
4. A large number of observations are necessary
5. Only homogeneous groups may be used in a single study. This is, identical machines doing identical work
6. A definite basis of "down" or "running" must be established
7. Long delays should be recorded as a single delay.

In some experimental work now being done, a tape-controlled camera was used to record observations. This method might reduce some of the pitfalls of the first five precautions, but increase the possibility of misinterpretation of the last two.

References

1. Fetter, R. N.—"The Assignment of Operators to Service Automatic Machines," *Journal of Industrial Engineering*, September-October 1955.
2. Morrow, Robert Lee—*Motion Economy and Work Measurement*, Ronald Press Co., N. Y., 1957.
3. Palm, Docent Conny—"The Assignment of Workers in Servicing Automatic Machines," *Journal of Industrial Engineering*, January-February 1958.
4. Saaty, Thomas L.—"Resume of Useful Formulas in Quening Theory," *Journal of Operations Research*, April 1957.
5. Weir, William F.—"Figuring the Most Economical Machine Assignment," *Factory Management and Maintenance*, December 1944.

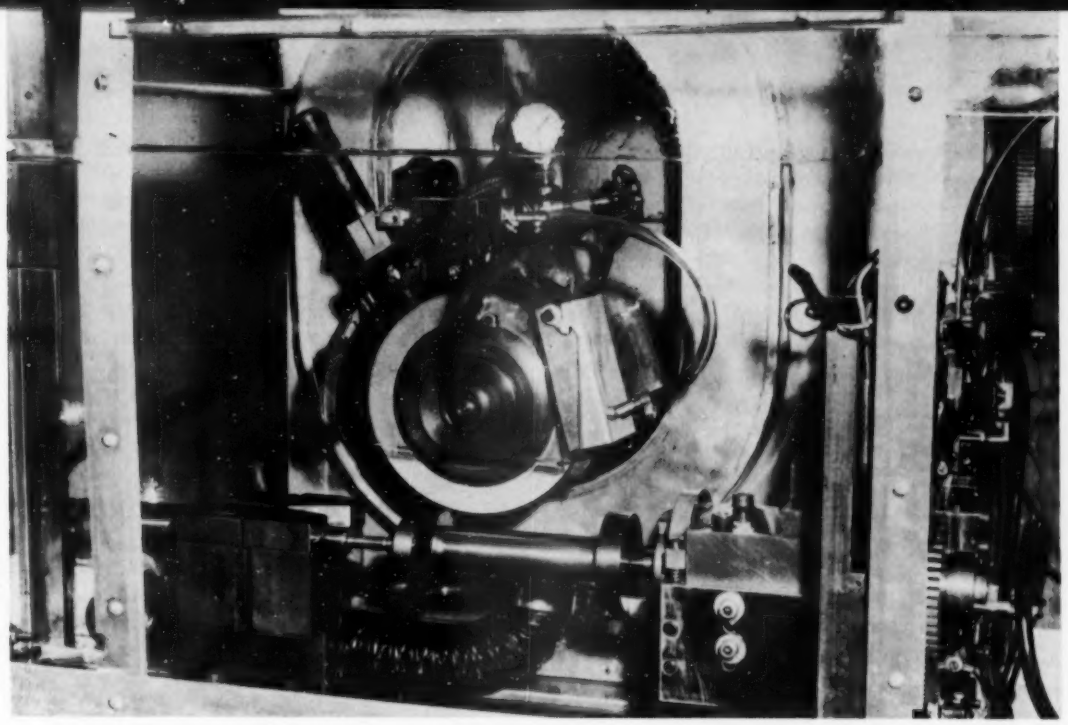


Fig. 1. Grinder adapted for precision finishing hobs. Location surfaces are ground on the machine to improve the accuracy of the workpiece.

tooling for PRECISION DEPTH HOBBING

By Alex Phillips
Department Head
Magnetron Dev. Lab.
Raytheon Mfg. Co.
Waltham, Mass.

Intricate cavities can be produced by pressing a master plug or hob into a block of steel to cold-extrude the desired shape. Special tool steels, controlled grinding conditions and proper tool holders are required to produce a precision part. The author discusses the tool steel selection and shows how hobs with the desired accuracy are produced within the limitations imposed upon the process by the tooling and the materials formed.

PRECISION DEPTH HOBBING differs from standard coining or hobbing (hubbing) operations in that a high degree of precision is required on the vertical side walls rather than on the bottom of the impression. This cold extrusion process has been refined to enable the production of intricate internal passages for magnetron power tubes. These passages are virtually impossible to form with any degree of precision or economy by other methods.

In producing the multiple cavity in a magnetron, an intricately ground hob, *Fig.* 1, is pushed into a block of metal. Usually a hydraulic press of from 100 to 1350-ton capacity is used. In a typical application, a compression force of 750 tons is applied to a 3-inch OD hob. As the hob is forced into the blank, the metal cold flows and assumes the shape of the hob as shown in *Fig.* 2.

Success of this process depends on the hob accuracy. A typical magnetron-cavity hob, *Fig.* 3, is made by grinding slots radially to the circumference of a cylinder. This result is a tool with pie-shaped spokes radiating from the center section of

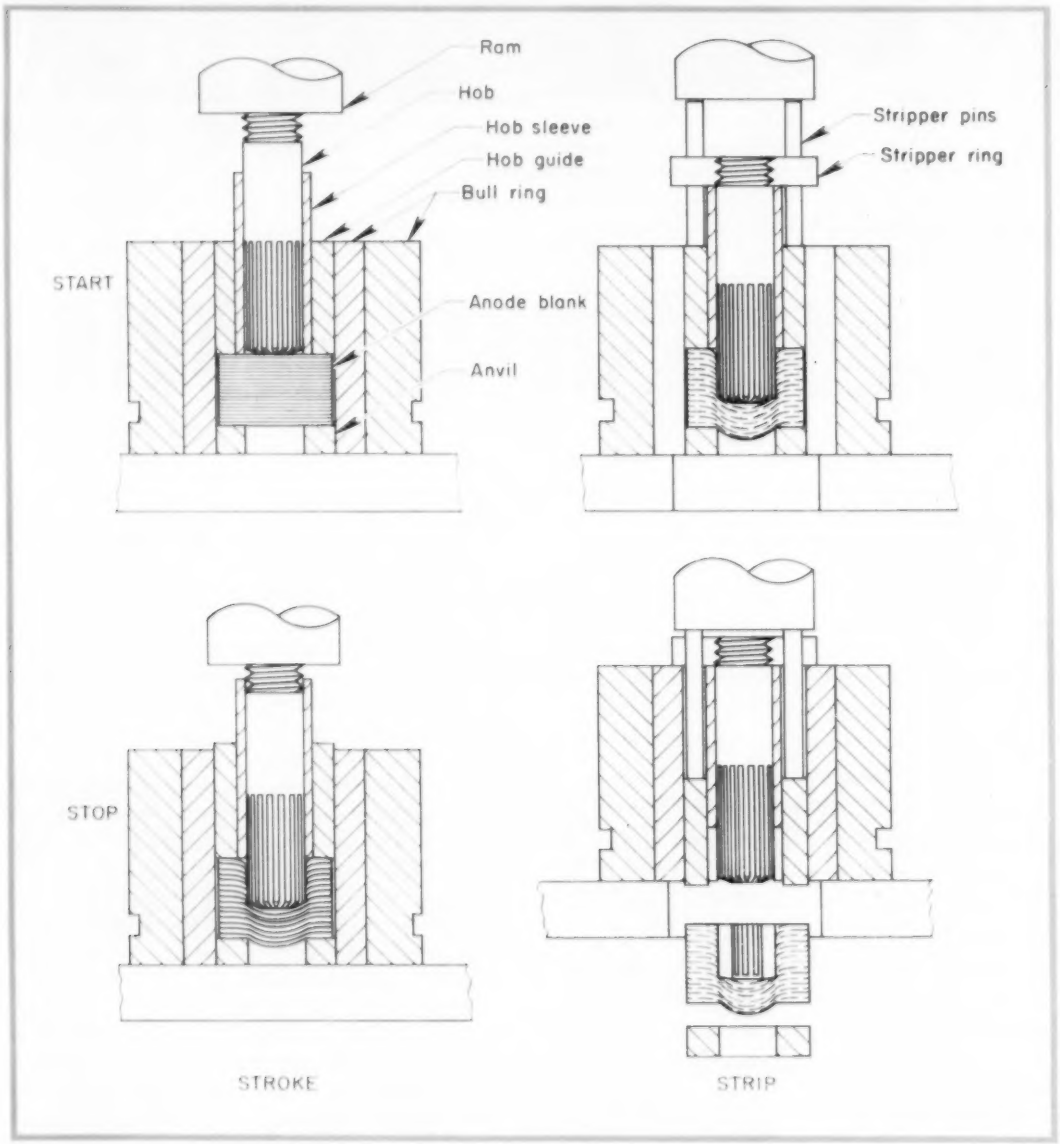
the hob, with the narrow end of the spokes nearest the center. Other shapes that have been successfully hobbed to close tolerances are internal squares and rectangles with concentric rings, cones with concentric rings and dumbbells.

Hobs may have slots as small as 0.006 inch; sharp, stress-concentrating corners; and narrow sections butting against heavy sections. Such shapes can withstand only compression forces. To prevent the hob from buckling in the press, guide sleeves are used.

The majority of hobs are of air-hardening tool steel with an analysis of 0.70 percent carbon, 2.00 percent manganese, 0.30 percent silicon, 1.00 percent chromium and 1.35 percent molybdenum. The analysis is designed to achieve maximum hardenability and toughness with a minimum total percentage of alloys for effective operation.

The tool steel used for these tools has good nondeforming properties. Minimum size change occurs at a drawing temperature of 300 to 400 F. A 1-inch long piece will expand about 0.0005 inch when hardened, but when drawn at 400 F will return to within 0.0003 inch of its original length.

Fig. 2. Steps in the formation of a cavity by precision depth hobbing. During the stroke, the hob is forced into the metal blank by pure compression. Hob sleeves and guides add lateral support to prevent hobs from shattering. In the stripping operation, the stripper pins push the workpiece off the hob ejecting anvil and workpiece from the work area.



One of the early problems encountered when making hobs was cracking. The blanks were being quenched in a handmade wire frame, *Fig.* 4, and the cracks were associated with the location of the wire. This problem was solved by redesigning the blank. An extra tip with a hole drilled across it diametrically was added. The heated blank is hung in the air stream by a wire through this hole. After hardening, the tip is removed.

All metal-removing operations except for rough turning the hob blank are done after hardening and tempering to C-59-60. The finish grinding operation is extremely accurate. The hob is held between centers mounted in V-Blocks and these blocks are finished ground right on the machine. This procedure assures accuracy and alignment while minimizing setup error. A light first cut is taken from the hardened and tempered hob blank. The hob is indexed by the electropneumatic indexing mechanism and another cut is taken. On the first time around the blank, cuts as heavy as 0.002 inch are used. As the depth of slot increases, the feed is reduced. Some passes may remove as little as 20 millionths of an inch of metal.

Once the grinding of the hob splines is started, it is carried on without interruption, 24 hours a day, until the part is completed. This prevents distortion in the machine due to ambient temperature changes resulting in closer tolerances on the workpiece. Temperature of the light oil coolant is also carefully controlled. Heaters and coolers regulate the oil temperature in the reservoir. A magnetic separator removes the larger grinding chips and the oil is passed through filter paper to remove all particles larger than two microns.

The grinder is a Norton 6 x 18-inch surface grinder. A number of special features have been provided to maintain consistent accuracy under all conditions. In addition to temperature controls interlocks have been added to stop the machine if there is an excessive dwell of one-tenth second, if the locking plunger in the index plate is not positioned properly, or if anything else happens, such as an external power failure.

The controls proved to be a source of trouble. Even though the hood was made of lightweight material, *Fig.* 5, and the parts were carefully designed, their weight on the traverse ways proved to be

Fig. 4. Original wire form used in the heat treatment of hobs caused cracks. Redesign of hob blank to include a tip for holding the blank during the quench operation eliminated this problem.

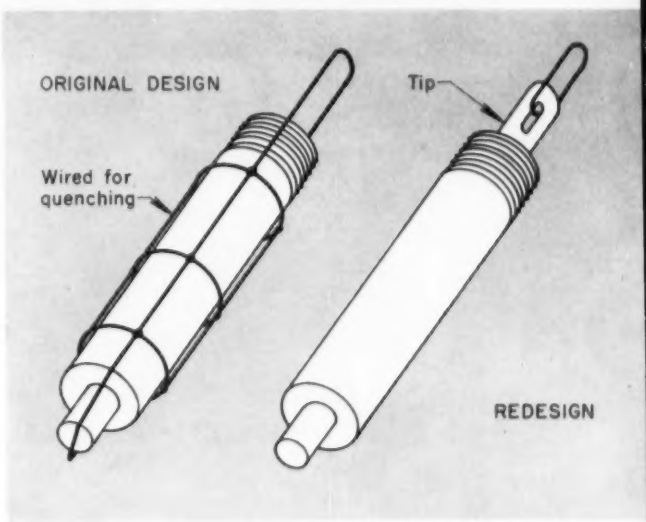
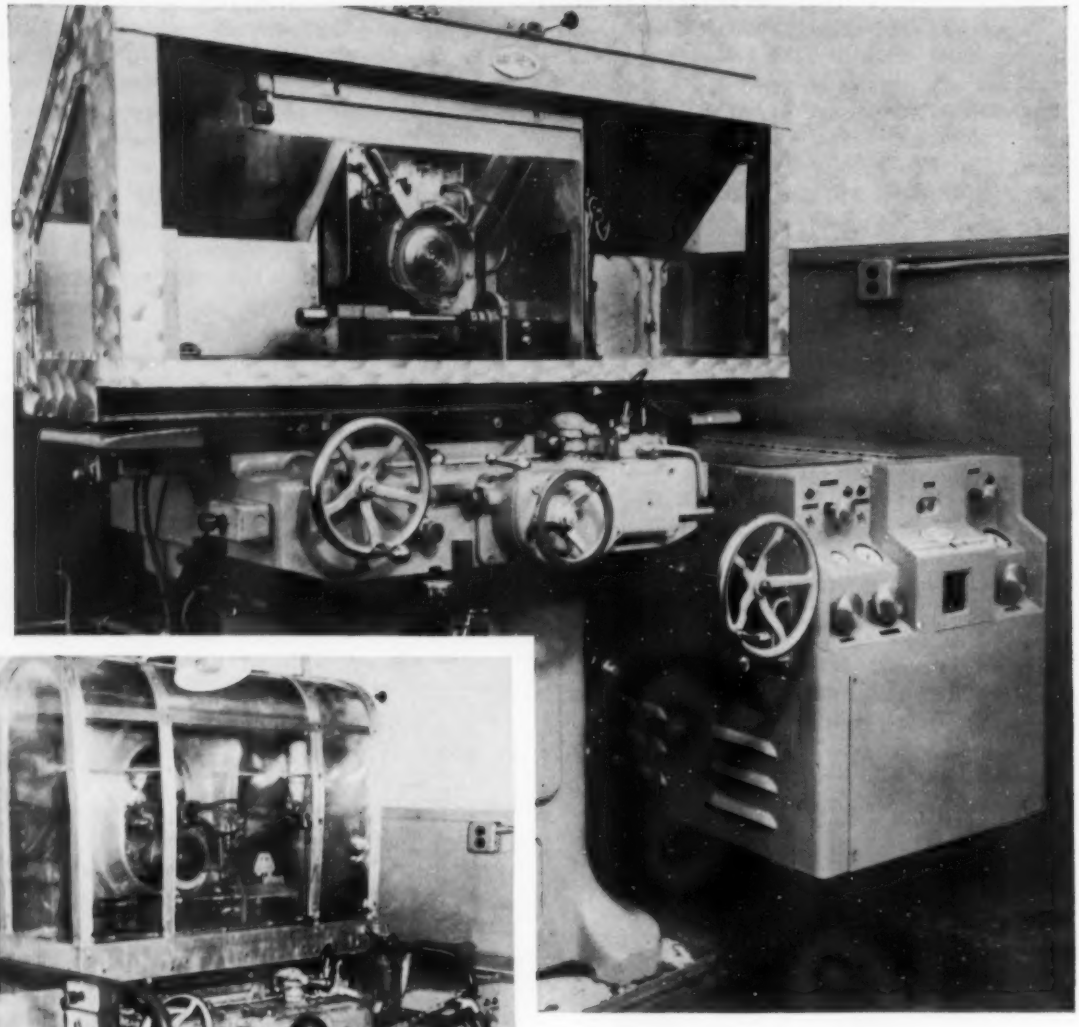


Fig. 3. Typical hobs used in the forming of magnetron cavities.



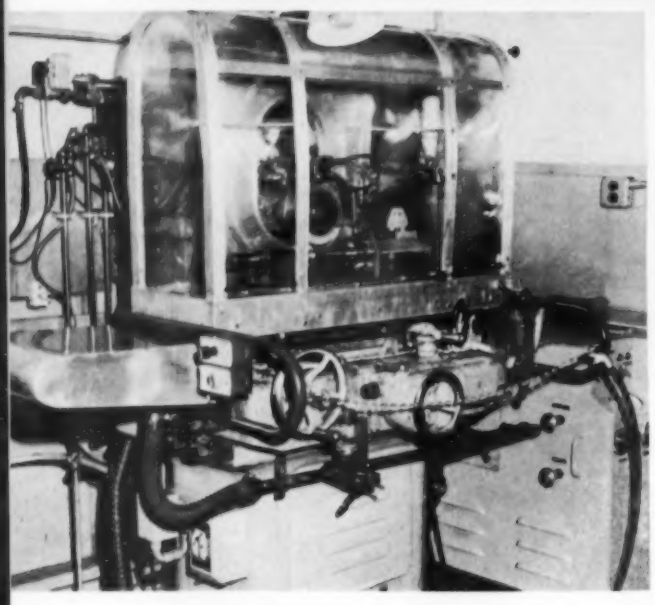


Fig. 5. (above) Refinements to the hob grinder became a detriment to the machine's accuracy. The additional weight of the canopy supported on the traverse ways caused inaccuracies in the finished workpiece.

Fig. 6. (left) Canopy redesign has weight transferred to special support bars fastened to the machine bed.

enough to influence accuracy. To counteract this condition the machine was rebuilt. The aluminum and plastic enclosure was replaced with an even lighter weight plastic canopy. All the weight was transferred from the ways to support arms anchored to the machine bed as shown in *Fig.* 6.

All of this preparation may seem to be a lot of trouble for a tool that averages only several thousand impressions. However, considering the time factor alone, it is well worth it. Precision depth hobbing cuts the production time per part from 3½ hours to 5 minutes. Material savings are also substantial, but most important is the accuracy achieved in the finished product. No other process has been able to produce the intricate magnetron cavity with accuracies even approaching that of cold hobbing.

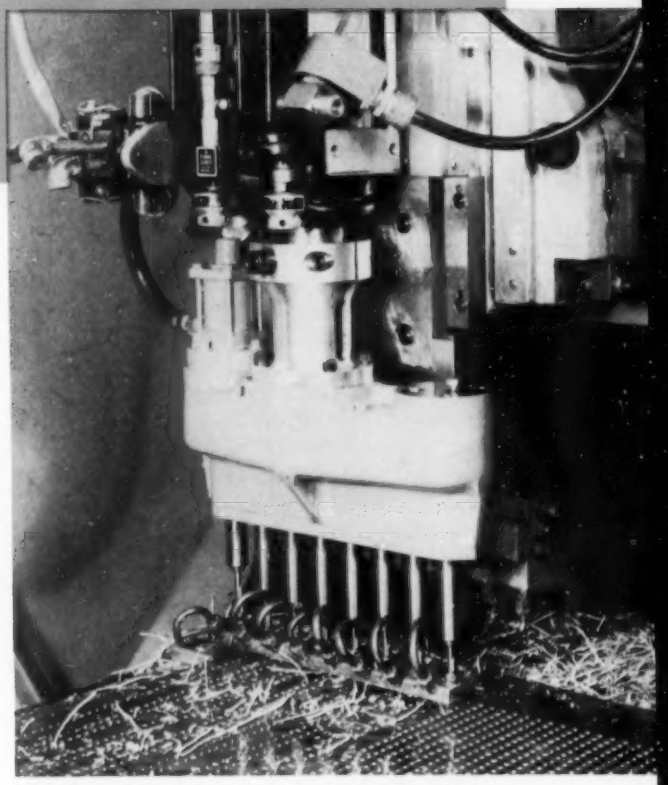
The usefulness of precision depth hobbing is not restricted to magnetrons or to the special copper used. Successful experimental work has been done with other copper analyses and with aluminum. Now that most of the hob-making problems have been solved, the process can be selected for difficult forms on the same basis as any other proved process—cost per finished part.

Numerically Controlled Drilling

. . . a case study

By Josef Wolf*
Tool Design Engineer
Electronic Associates, Inc.
Long Branch, N. J.

Drilling of many holes in a short time requires the use of special techniques and equipment. Tape-controlled machines and multiple-spindle drilling heads solved a problem of this type in the author's plant.



Eight-spindle head for drilling holes in aluminum computer plates. The head is controlled by a punched tape which determines the hole locations and table positions. One spindle has been retracted to prevent drilling in the edge position because the hole pattern was not divisible by eight for all drilling positions.

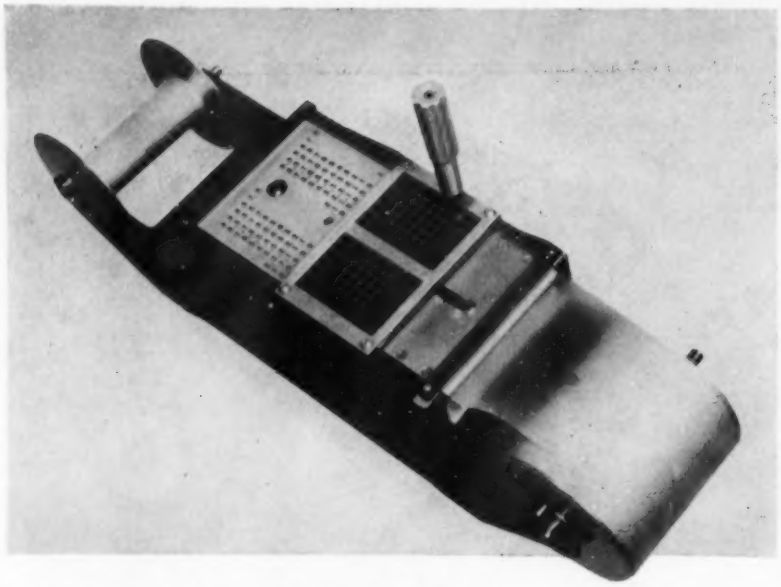
EFFICIENT DRILLING METHODS are mandatory when large numbers of holes are to be drilled. Drilling problems are especially serious when hole locations are critical. Such a drilling problem is found in the production of a patch panel of an analog computer. The part is made of 5/16 inch thick aluminum alloy plate, ground and straightened within close limits.

The arrangement of the 3450-hole pattern is 75 holes on the *X* coordinate (horizontal plane) and 46 holes on the *Y* coordinate (vertical plane). The *X*-coordinate hole spacing is on 0.4375-inch centers and the *Y*-coordinate spacing is on 0.312-inch centers. Hole-to-hole tolerance between any two holes on the entire panel must not exceed 0.005 inch TIR in either plane. To insure good electrical contact, the hole size must be held to 0.219 + 0.001 — 0.000 inch. The hole must be smooth and surface finish must not exceed 32 microinches, rms.

This problem was not new since a special drilling machine had been developed for a similar computer patch panel. These panels had the same dimensional restrictions except there were only 1800 holes. For this previous job, a standard milling machine bed and post was altered to hold a special four-spindle head and indexing mechanism.

The mechanical type of drilling equipment was adequate from a dimensional standpoint, but did not offer the productive capacity to drill the 3450-hole panel efficiently or economically. Therefore, a Hillyer tape-operated machine was employed to

*Senior member ASTE Monmouth chapter.



Manual tape punch for the preparation of control tapes used in the drilling machine. Positions of the head and table are controlled by the hole pattern.

gain optimum efficiency and dimensional control. This machine was modified by removing the single-spindle guide and replacing it with a special eight-spindle head. Use of this equipment increased production 700 percent. The head is of special design because the form factor of the hole pattern is not divisible by eight. Consequently, one of the spindles must retract on the last two rows of holes. Withdrawal of the spindle into the head is accomplished with a double-acting air cylinder, operated by tape control.

The retractable spindle is housed in a hardened-steel sleeve which in turn slides within the cylinder casting when the cylinder is activated. The pinion gear that drives the spindle is always engaged with the spur gear, so matching of gears during or preceding a cycle is not required. Spindles have fixed centers of 1.3125 inch. This spacing allows for three passes of the head on each row of holes.

The gear train for the drill head is housed in a casting that has been fitted with ball bearings for the drive spindles. The pinion gear that drives the retractable spindle is made with more compact powder-metal bearings because of space limitations. Ratio of the gear train is 1:1 to help the operator ascertain the exact speed of the spindle in relation to the dial setting of the machine. This leads to better efficiency when drilling various materials, without risk of human error in calculating spindle speeds. The gears in the gear train have been calculated to afford maximum wear resistance. An odd number of teeth have been used for both the pinion and spur gears.

Lubrication is a major consideration when drilling 3450 holes in 60 minutes. After trying a number of different methods and materials, it was determined that a Norgren spray lubrication system proved to be the most satisfactory from a lubrication standpoint as well as chip removal. The air pressure from the lubrication unit blows the chips off the panel and into a chute. Chips then go into a special barrel where they are saved as scrap. About 25 percent of the total weight of the initial plate is converted to chips.

A special mounting fixture has been devised to receive panels or plates that have irregular starting points. As a result, the setup time between drilling operations has been cut to a minimum.

A major feature of the drilling setup is the eight-spindle head, which may be removed in 30 minutes and replaced with the single-spindle head or another multispindle variable position head. It is possible to make templates and tapes quickly for punching operations. Use of the three available types of drilling heads plus the flexibility of the Hillyer tape-controlled machine offer many advantages for short-run drilling operations.

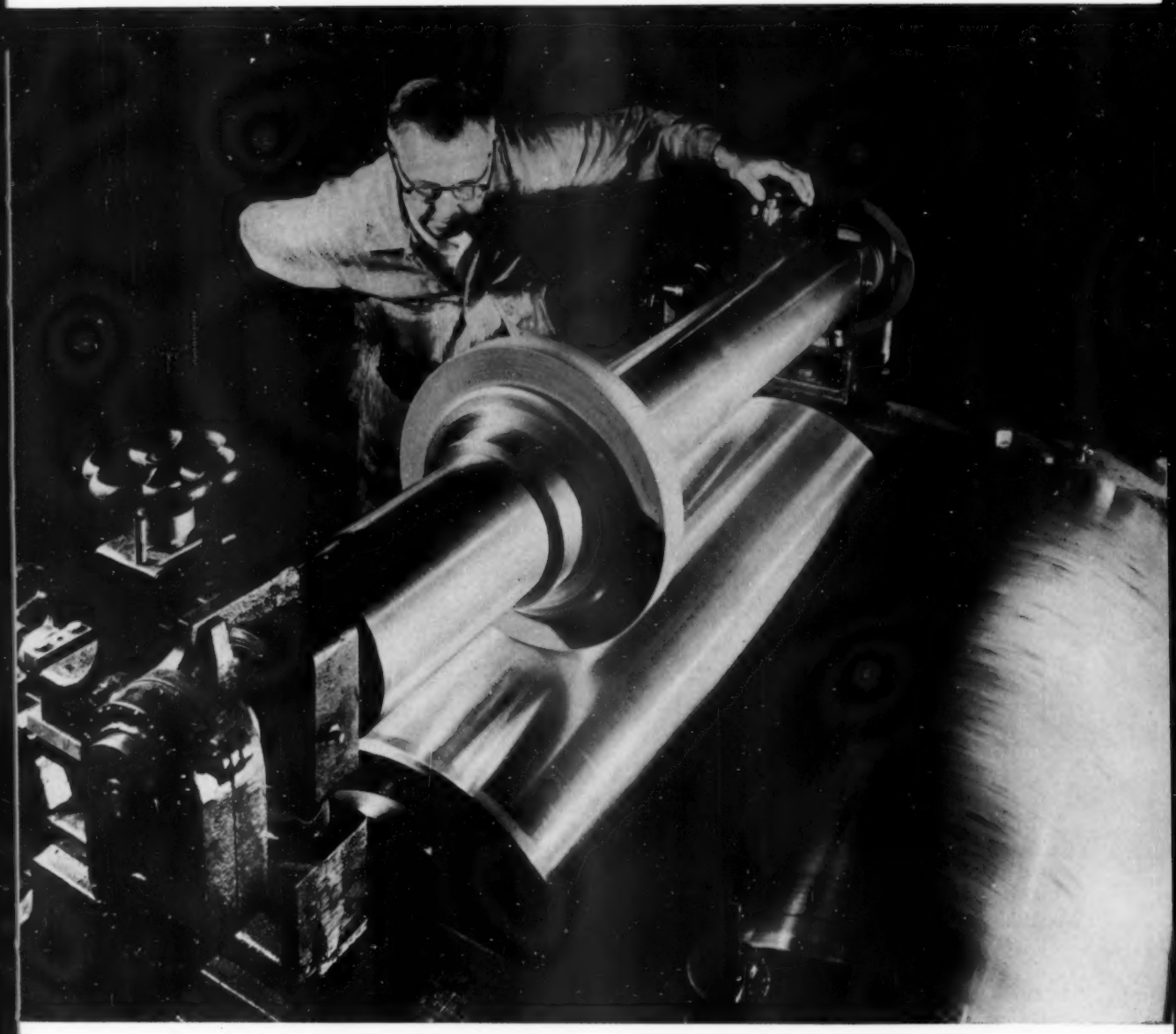
CORRECTION: In the article, "Reaming Accuracy Improved with Coolants" by B. L. ten Horn, R. A. Schuermann and J. Slaats in the March issue, an unfortunate error appears in the charts. The diameters, shown as ordinates in the charts, used the following series and read:

0.310 0.312 0.314 0.316 0.318 0.320 etc.

They should, however, read:

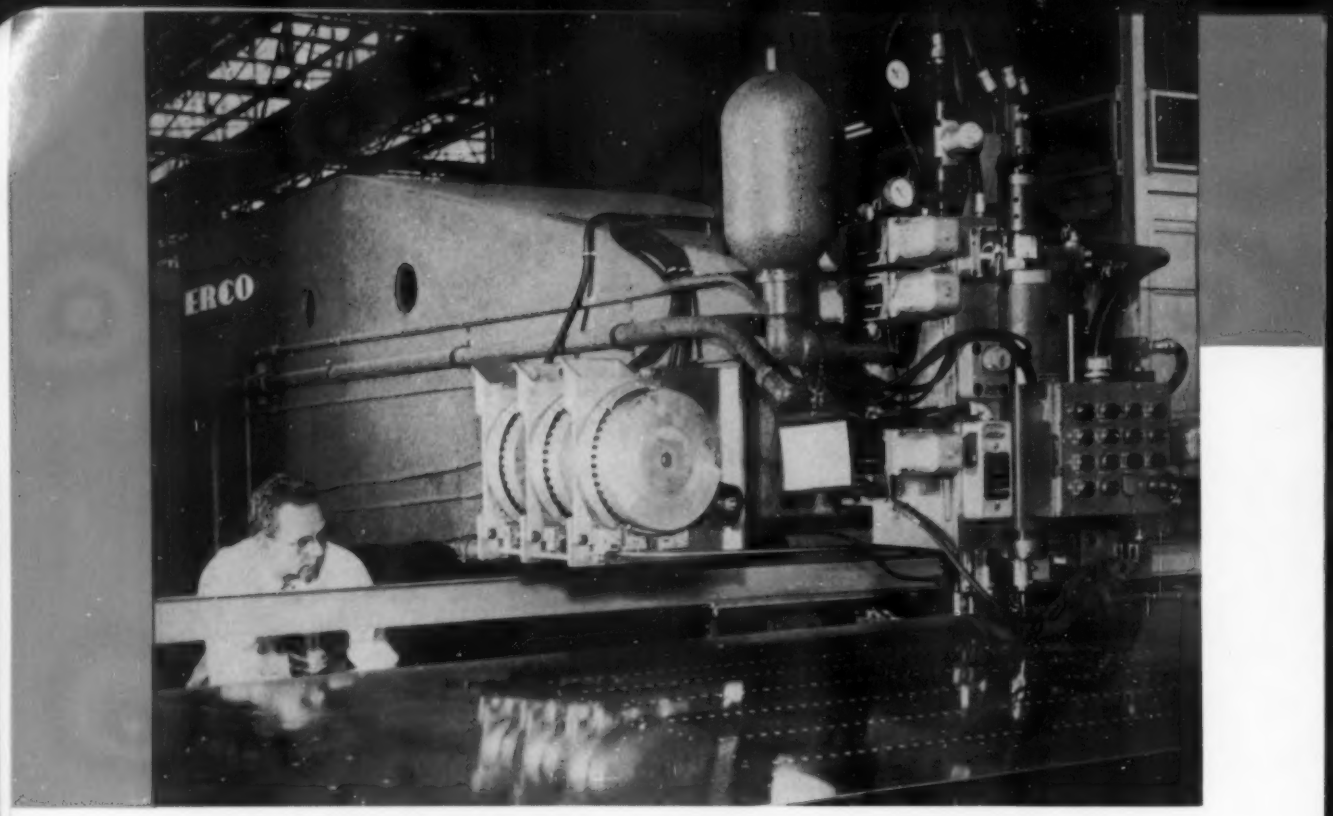
0.3145 0.3147 0.3149 0.3151 0.3153 0.3155 etc.

This means that every line increment on the diameter scale represents 0.0001 inch instead of 0.001 inch. In other words, the authors work represents an accuracy ten times greater than that shown in the charts. —ED.



PORTABLE GRINDER used to retrue large rolls has replaced manual methods. Formerly, hand stones or other hand-held abrasives were used to touch up nicks or gouges. Close-tolerance grinding was impossible unless the mill was dismantled and the rolls returned to the manufacturer. Periodic redressing eliminates the need of removing large amounts of stock to establish trueness. The portable grinder redresses to within 0.00045-inch roundness and straightness without removing the roll from the mill. The grinder, shown in use at Manifold Supplies Co., was constructed by B. S. Roy & Son.

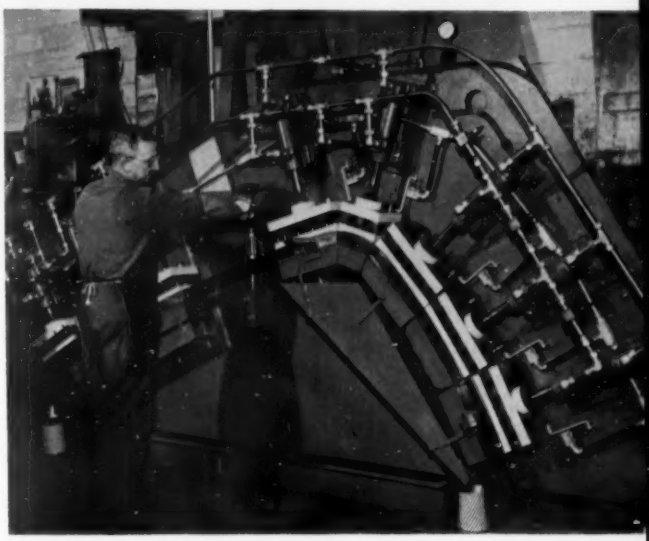
TOOLS at work



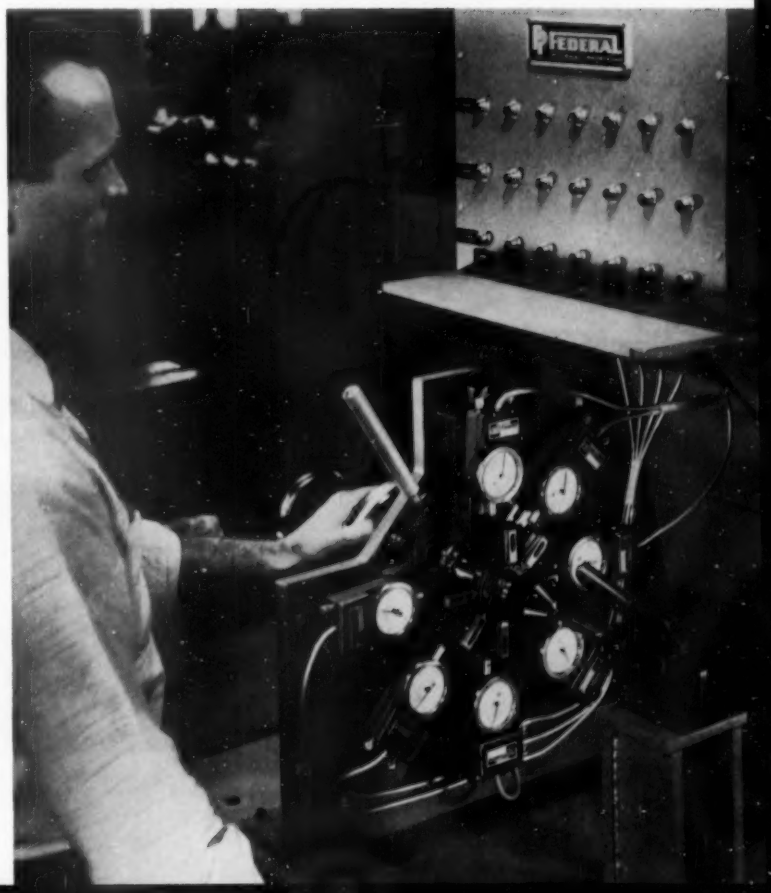
ATTACHING ALUMINUM SKINS to wing and fuselage framework, this riveting machine completes a riveting cycle every three and one-half seconds. The 21-ton machine drills, countersinks and counterbores a hole, inserts a rivet, sets it and shaves off the head. The riveters automatically sense the thickness of the tapered wing skin at the point of drilling and send the proper length rivets to the riveting head. The riveters, built by Erco Div. of ACF Industries, and in operation at Convair Div. of General Dynamics Corp., are used in conjunction with automatic positioners which move the wing panels back and forth through the jaws of the riveter. Hole locations are determined by template and electric eye pickup. The entire operation is controlled by an operator from a remote control pushbutton console or panel by predetermining desired manual or automatic cycling. The Convair-San Diego tooling department designed and built the positioners and control consoles. Each riveter measures 12½ ft high, 15 ft long and 6 ft wide, with a 10½-ft throat depth. These dimensions permit the riveter to handle skin and stringer panels up to 12 ft wide and 25 ft long.

FLEXIBLE BALL MANDREL developed at Boeing Airplane Co. is used to make bends in thin-wall tubing without crushing. The mandrel has a threaded pin with a spherical head to interconnect a series of steel balls. The head of the pin fits into a spherical seat in the ball, permitting movement in any direction. This design combines the flexibility of a cable mandrel with the strength of a link mandrel. The mandrel gives bends with a radius as small as twice the tubing diameter. Pines Engineering Co. is manufacturer.

TOOLS at work



SERIES OF hydraulically operated punches pierce a bus frame member with a pattern of holes in one operation. Cycle time is seven seconds. The number of holes ranges from 45 to 71 depending on particular part requirements. The machine can pierce or not pierce holes as required. The holes prepare the body frame for riveting the outside skin of the bus. The body post, after piercing, is cut to a specific length and then an overlap is made to another section before going to the assembly line. Each die set is driven by a hydraulic cylinder and is set in a self-sequence order so that there is an automatic corrective factor to insure accuracy. The machine, which is in operation at Mack Trucks, Inc., was built by F. W. Armitage, Inc.



GROUPS OF SEVEN different cams, arranged in stacks, are checked for contour, proper stacking, and broken or chipped edges on a semiautomatic Federal electric gage. A master cam stack is permanently positioned on a precision locating shaft. The stack to be checked is positioned on the same shaft and held tightly in place by a pressure plate. Reference contacts ride the contours of each of the seven cams in the master stack. The gaging contacts which check the workpieces are coupled to the reference contacts by means of pantographs and follow them as the shaft is rotated. Electric dial indicator gaging units contact the pantographs and any difference causes the indicator to move. The spindles actuate switching contacts which control signal lights. The inspector rotates the handwheel one full turn to check the leading edge of the cams. He then changes the position of the cam stack and checks the trailing edges.

WALLS OF THE PROPELLANT TANKS in the Titan ICBM also form the missile's outer skin, becoming an integral part of the airframe. They are fabricated from large extrusions produced on a 14,000-ton press at Alcoa's Lafayette works. Shapes come from the press in 20 foot long inverted V's.

TOOLS at work

ALUMINUM EXTRUSIONS are flattened into 34-inch widths and shipped to the Martin Co. for stretch forming, chemical milling and welding operations.

applications of
RETAINING RINGS

By Hugo Wurzel
Chief Design Engineer
Truarc Retaining Rings Div.
Waldes Kohinoor, Inc.
Long Island City, N. Y.

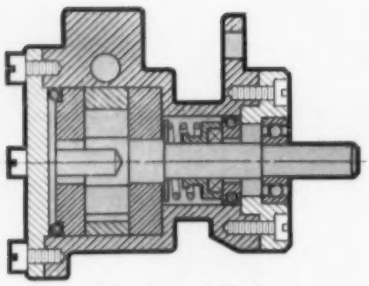
Product simplification is one means for reducing manufacturing costs. The author shows how retaining rings simplify assembly operations and make it possible to eliminate some machining operations as well.

RETAINING RINGS offer a practical solution to many of the fastening and positioning problems frequently encountered in product design. Snapped into a circular groove on a shaft or in a bore or housing, they provide a removable shoulder which may be used to accurately locate, retain or lock components in machine assemblies and other applications. Because of their functioning characteristics and ease of assembly and disassembly, *Fig.* 1, retaining rings often may be employed to replace bulkier and more expensive fastening devices which require preparatory drilling, threading, tapping and other costly machining operations. In some cases, the rings have been used to achieve product designs which would have been impractical with other fastening methods.

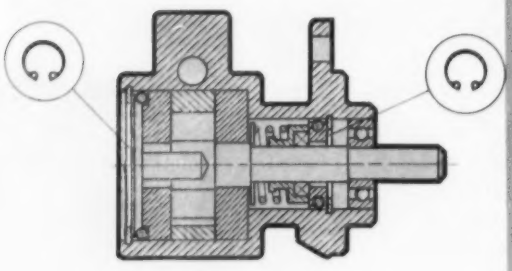
Retaining rings are available for both axial and radial installation. Internal type rings are used in bores and housings; external types on shafts, bosses and studs. Both types are equipped with holes in the lugs for easy installation and removal.

Fig. 1. Rapid installation of locking prong retaining ring speeds assembly. Rings are stacked in dispenser at right. Operator uses applicating tool to grasp bottom ring in stack. Ring is assembled radially in one quick motion.

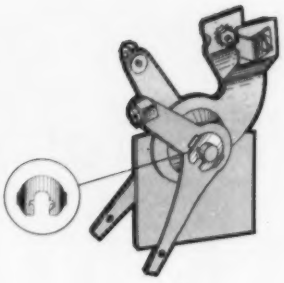
While most rings are seated in grooves, a number of self-locking types do not require a recess. The self-locking rings are particularly useful for assembly on castings, parts made of plastic and other materials which are difficult to groove. They are valuable also for assemblies in which tolerances in the parts being retained make accurate groove location difficult. Bowed and beveled rings, which provide substantially higher thrust load capacities than the self-locking types, are useful in assemblies where the ring must provide a certain amount of end-play take-up.



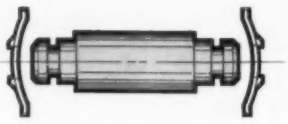
ORIGINAL DESIGN



NEW DESIGN



ORIGINAL DESIGN



NEW DESIGN

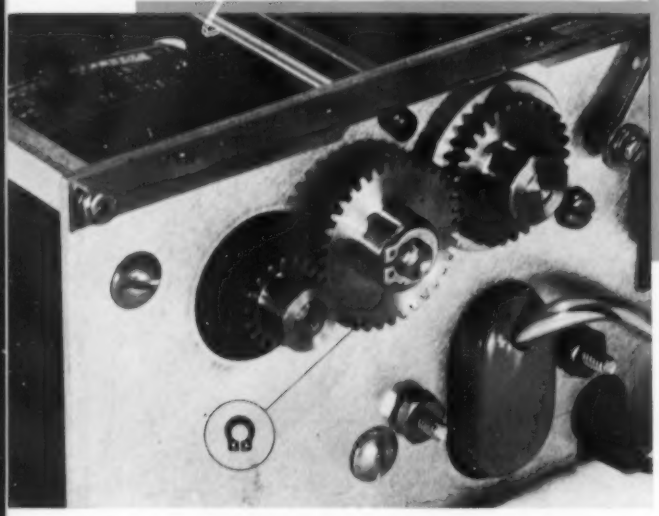


Fig. 2. (upper left) Two cast retainer plates and eight screws were required for assembly of pressure pump. Redesigned pump uses two standard internal rings to replace castings and screws.

Fig. 3. (above) Two rings replace six fastening devices formerly used in automotive heater control.

Fig. 4. (left) Grip ring used on redesigned gear assembly does not require a groove.

Replacement of Other Methods

Retaining rings are employed in a wide variety of consumer and industrial products. The pressure pump illustrated in *Fig.* 2 is a good example of how the rings are used to replace threaded or bolted cover plates and flanges. In the original design, cast plates were used at each end to retain the pump components. The plates were locked in position by eight screws secured in holes tapped through the plates into the pump housing. A simplified design was made possible by the use of two standard internal retaining rings. The rings replace the two cover plates and eight screws and eliminate the time-consuming tapping and assembly required with the original design. Savings in materials and labor amounted to $1.48 per unit. The rings also achieved a weight saving of 14 ounces, important in many applications.

Retaining rings also may be used to replace nuts and threaded shafts or studs. The automotive heater control shown in *Fig.* 3 originally was designed with a threaded shaft having a spring washer, lock washer and nut on each end. By using two bowed locking prong rings, the manufacturer was able to redesign the unit to incorporate the smaller, less expensive grooved shaft illustrated. The two rings replace the six fastening devices used in the old design and eliminate the threading operations.

The portable electrocardiograph gear assembly illustrated in *Fig.* 4 is another example of how a retaining ring—in this case, a grip ring which does not require a groove—may be used to replace a nut and eliminate a threading operation.

The ring secures the idler gear which regulates the speed of the electrocardiograph recording paper. Because accurate and uniform paper speed

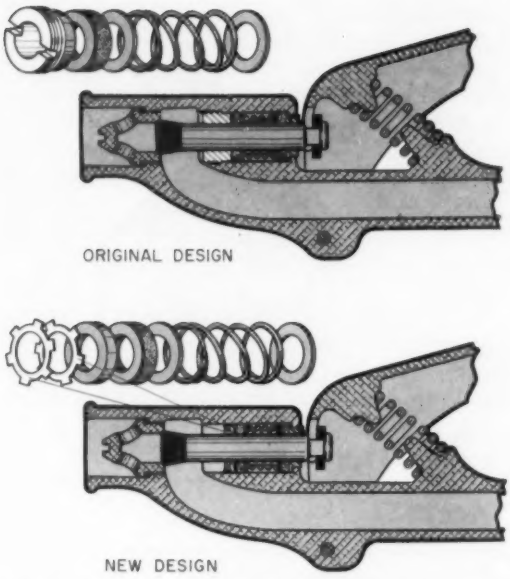


Fig. 5. New design for fire extinguisher nozzle has two self-locking retaining rings seated against washer-abutting seal. This replaces stainless steel plug, simplifies assembly operations.

is critical for diagnostic accuracy, faultless gear performance is a mandatory operating requirement. The grip ring satisfies this requirement by assuring precise seating of the gear on the hub. It also eliminates the necessity of threading the stud and using a nut which added to the over-all bulk of the unit. The grip ring, which exerts a frictional hold against axial displacement, is installed flush with the gear hub. Because no groove is needed, the ring may be seated at any point on the stud and automatically compensates for accumulated tolerances in the parts. Unlike the nut, the ring does not require any torque. As a result, the fastener eliminates the danger of binding or wobble in the gears encountered with the original nut and threaded stud design. Savings with the ring in labor and materials amount to $365 per 1000 units.

The fire extinguisher nozzle in *Fig.* 5 illustrates how retaining rings may be used to replace threaded plugs and sleeves. The original design used a threaded stainless steel plug to secure the plunger packing seal. The plunger's friction drag had to be uniform despite the fact that the felt seals varied greatly in thickness. It was possible to compensate for these variations only by a slow, careful—and extremely costly—assembly.

The company solved the problem by redesigning the unit as shown. Two self-locking retaining rings are positioned against a washer abutting the seal. Because the rings do not require a groove, it is possible to locate them at any point in the housing to accommodate variations in seal thickness. Assembly with the rings increased production from 25 to 60 units per hour—an increase of 140 percent—and cut costs $0.06 per unit. The new design is $\frac{1}{8}$ inch shorter than the old.

Heat forming and staking operations on plastic parts sometimes cause rejects which nullify any production savings that might otherwise be obtained. The reflex camera components illustrated in *Fig.* 6 are a good case in point.

The lens knob assembly formerly was secured by flattening the knob's plastic shaft over a washer by means of a heat-forming operation. Cracked shafts caused a high percentage of rejects. To eliminate the rejects, the manufacturer redesigned the assembly to incorporate an external push-on type self-locking retaining ring. The ring eliminates the washer and heat-forming operation and also permits the knob to be removed without damage to the lens assembly.

The camera's rear film indexing window originally was secured by heat-forming tabs from the plastic body. Loose or chipped parts often resulted in the loss of both lens and body—an extremely costly reject. The problem was solved by using an internal self-locking ring which is installed quickly and easily in the lens recess. Here again the lens may be removed for service or replacement—a feature that was impossible with the old design.

The calculating machine motor governor illustrated in *Fig.* 7 is an example of how retaining rings may be employed to eliminate riveting operations. In the original design, the collector disk was riveted into position—an operation that required skilled labor. Once in place, the disk could not be removed. The redesigned assembly makes use of a standard external ring which replaces the three rivets. In addition to savings in labor and materials, the ring makes it possible for the disk to be removed for inspection or servicing.

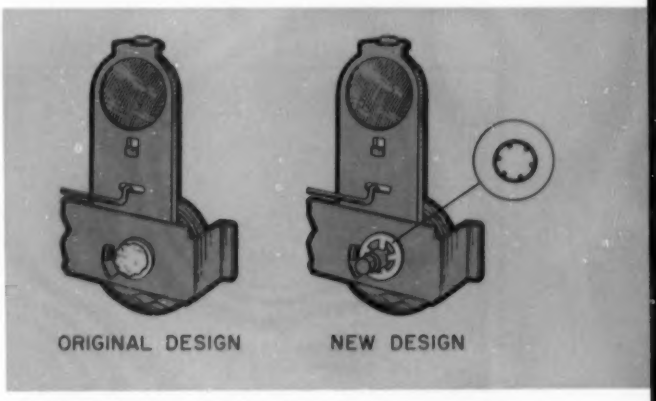


Fig. 6. Staking and heat-forming operations on reflex camera lens knob assembly were eliminated by using self-locking ring to hold components.

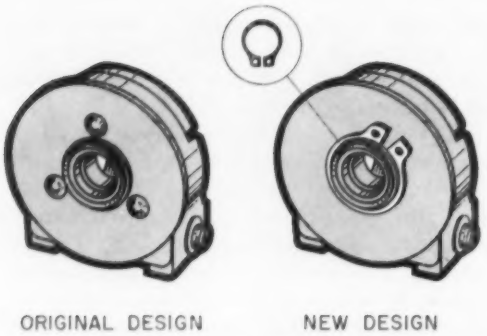


Fig. 7. (above) Collector disk of calculating machine motor governor was originally riveted in position. Retaining ring was used in new design to permit disassembly, eliminate riveting.

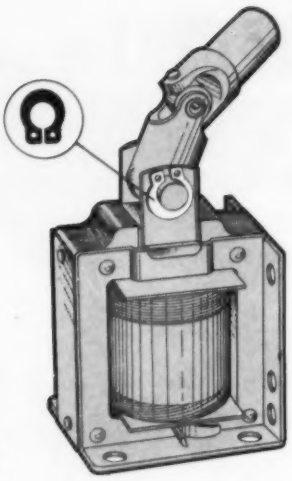


Fig. 8. (right) Cotter pins on vacuum switch actuating mechanism have been replaced by grip rings. No holes are required.

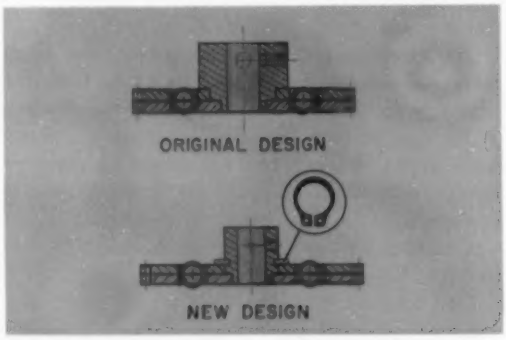


Fig. 9. Precision gears were originally staked on hub. With new design, gears can be separated for deburring, which was formerly impossible.

Retaining rings have been used successfully in a great variety of products to replace cotter pins and eliminate cross-drilling operations. The vacuum switch actuating mechanism shown in *Fig.* 8 formerly required two cotter pins to secure the universal joint to the solenoid plunger. The unit has been redesigned with a grip ring on each side to secure the hinge pin. Because the rings do not require grooves, they may be seated at any point on the hinge pin, automatically compensating for tolerances in the parts. In addition to eliminating the cotter pins and drilling operation, the rings also permit the company to buy standard straight pins as needed. With the old cotter pin design, special pins were required and it was necessary to stock a large inventory for parts replacement and for quick service on new orders.

Product Design Improvement

In addition to making possible substantial cost savings, retaining rings often may be used to simplify design and improve product performance. The precision antibacklash gears illustrated in *Fig.* 9 uses a standard external ring to achieve greater accuracy and reduce manufacturing costs by $350 per 1000 units.

The unit consists of two spring-loaded aluminum gears mounted on a machined stainless steel hub.

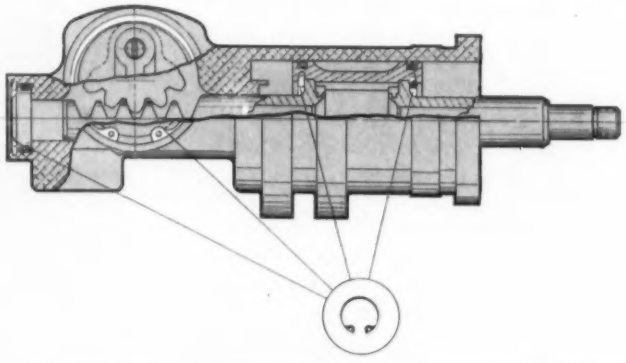


Fig. 10. Four beveled internal retaining rings lock components of automotive power steering piston assembly, provide positive seals.

In the original design, a blank for the floating gear was slipped over the back of the hub and positioned next to a machined shoulder. A similar blank for the fixed gear was seated against a second shoulder and staked to the back of the hub. The gear teeth were then cut in the blanks and the parts deburred. Because the two gears could not be separated, the deburring operation was slow and costly and rejects averaged 10 percent.

With the retaining ring design shown at the right, a smaller hub is used and one machined shoulder is eliminated. Assembly is made from both directions. The fixed gear blank is pressed onto the back of the hub and staked into position and the floating gear blank is slipped over the front of the hub and secured with the retaining ring. After the gear teeth are cut, the unit is disassembled and the gears deburred separately. The parts are then reassembled and once again secured with the retaining ring.

The new assembly provides a freer gear roll and, because of the improved deburring, greatly increases the accuracy of the unit. Costs for labor and materials are reduced 25 percent for a saving of $300 per 1000 units. Elimination of rejects caused by faulty deburring saves another $50 per 1000 units for a total saving of $350 per 1000 units.

The automotive power steering piston assembly illustrated in *Fig.* 10 is another example of how retaining rings may be used to improve product design and lower manufacturing costs. This unit incorporates four beveled internal rings. Two are used for locking the piston, rack and connecting rod; the other two for providing a positive seal.

In the original design, the piston and rack were machined from stock having an outer diameter equivalent to the largest diameter of the piston. The parts were costly and time consuming to produce and misalignment caused by machining tolerances often resulted in rejects. The assembly was sealed with two threaded plugs which required additional threading in the housing.

The beveled rings—which derive their name from a 15-deg bevel on the groove-engaging edge—are seated in grooves having a matching bevel on the outer groove wall. The wedge action permits the fasteners to take up end play caused by accumulated tolerances and, as a result, locks the parts rigidly in place. The rings assure alignment of the parts and provide an improved seal for the unit.

In addition to substantial savings in materials and labor, the rings make possible rapid disassembly of the unit during field servicing. Alignment of the parts during reassembly is achieved automatically when the rings are returned to their position in the grooves.

Assembly Tools

A variety of assembly tools are utilized for rapid installation and removal of retaining rings. Pliers for axially assembled rings have special tapered tips which are inserted into the plier holes in the rings to grasp the fasteners securely by the lugs. Internal ring pliers are designed to compress the rings for insertion into a bore or housing. External ring pliers expand the rings so that they may be slipped over a shaft. Stops are used on internal ring pliers to preset the spacing of the tips so that the tips align automatically with the holes in the rings. On external pliers, the stops may be set to prevent the rings from being overspread. For applications where space is limited, pliers are designed with tips bent to 30, 45, 60 or 90-deg angles.

Pliers for large size rings, *Fig.* 11, have a double ratchet construction which reduces the effort needed to compress or expand the rings. The ratchet also locks the pliers at any given point of expansion or contraction and serves as a safety mechanism for preventing the ring from springing loose accidentally. Pliers made of beryllium copper are used for ring applications where nonsparking or nonmagnetic tools are required.

Axially assembled rings may be installed rapidly

Fig. 11. Ratchet pliers for large-size rings. Double-ratchet construction lessens effort necessary to compress or expand rings.

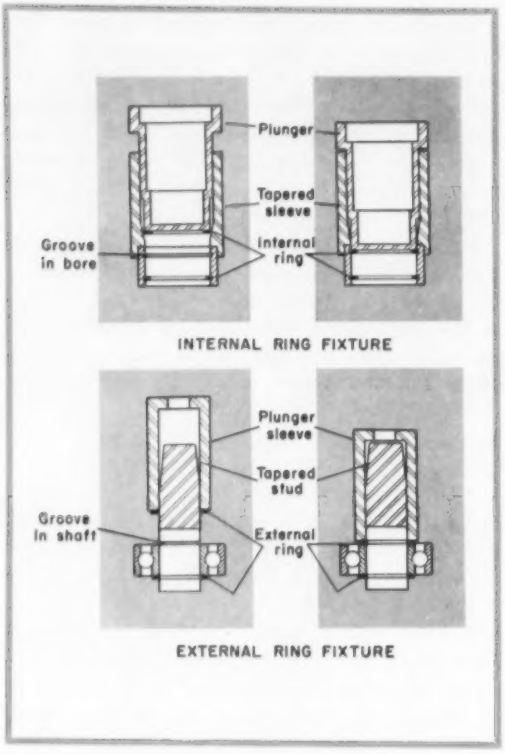


Fig. 12. Representative assembly fixtures for axially installed rings.

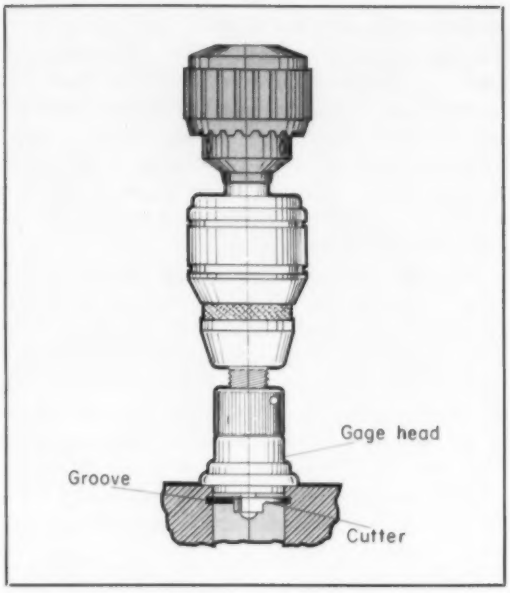


Fig. 13. Typical grooving tool for retaining ring recesses.

with simple fixtures that can be made easily in most shops. Two plunger type fixtures are illustrated in *Fig.* 12.

The fixture shown at the top is for internal rings. The ring is placed into a sleeve with a tapered wall and pushed downward by a plunger into the narrower part of the sleeve. Then the ring is compressed until its diameter is smaller than the diameter of the bore in which it is to be installed. When the plunger is depressed fully, the ring snaps into the groove.

The external ring fixture at the bottom of *Fig.* 12 works essentially the same way, except that the ring is expanded rather than compressed. The fastener is placed on the narrow end of a tapered stud and pushed downward until it is expanded sufficiently to clear the shaft. When the ring reaches the groove, it snaps into position.

Radially assembled rings can be installed rapidly with applicators and dispensers which may be operated at a high rate of speed even by unskilled labor. Applicators are hand tools which can be used either with loose rings or with specially stacked rings designed for use with dispensers. The rings are picked up in a milled recess on the underside of the tool and installed radially on a grooved shaft. Because the ring's gripping power is greater than the gripping strength of the tool jaws, the tool can be removed easily once the ring has been installed in the groove.

Grooves for retaining ring assemblies are often machined with grooving tools designed for the purpose, *Fig.* 13. These tools are designed for use in any machine tool equipped with a collet or chuck. Either the tool or the workpiece may be rotated for groove cutting.

The tool shown is equipped with a gage head assembly for piloting from the face of the workpiece. It is possible to equip the tool with a special bottoming adaptor for locating grooves from an internal surface. An attachment permits cutting external grooves on shafts, studs and bosses.

In addition to retaining ring grooves, the tool may be used for cutting oil grooves, O-ring grooves, thread reliefs and all other recessing operations where it is possible to establish a piloting surface from an external, internal or fixture surface.

It should be pointed out that tool engineers today have an important role in cost-reduction programs. In many plants, product designers and tool engineers work together as the product design is being developed. The familiarity of the tool engineer with manufacturing processes insures that manufacturing problems are taken into consideration.

The retaining ring applications illustrated are typical of the way in which a simplified design can cut manufacturing costs. Similar and new applications are being made every day by cost-conscious designers everywhere.

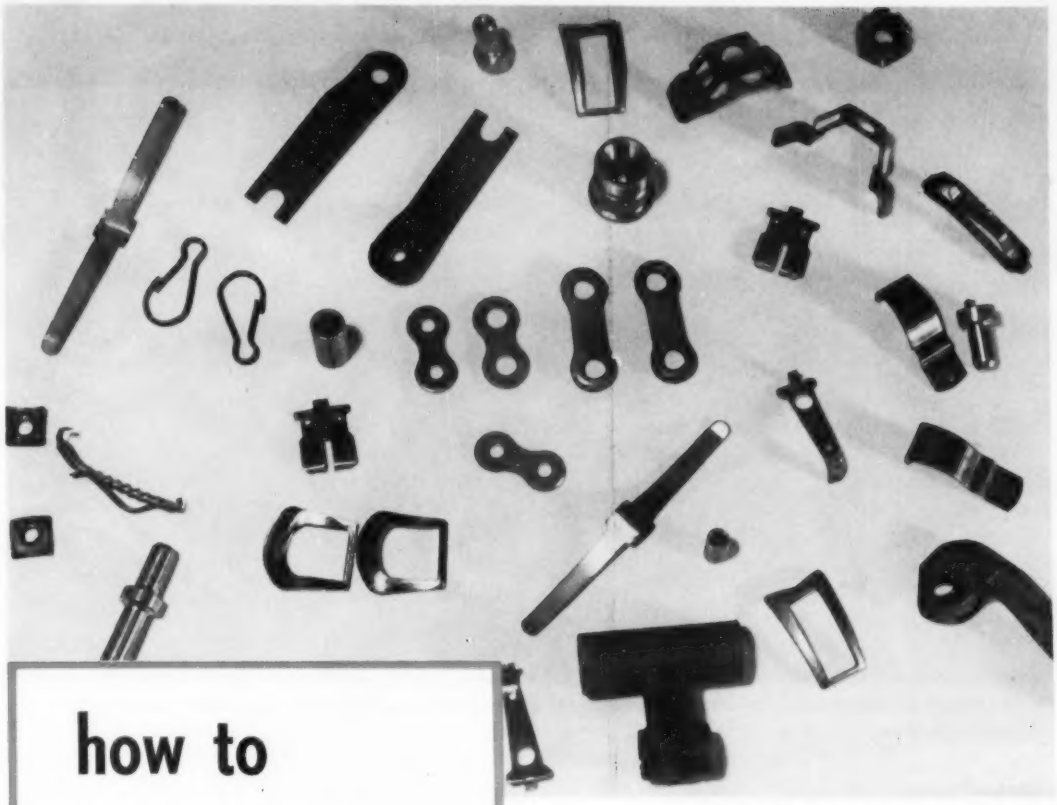


Fig. 1. These parts are representative of small steel springs and stampings that require heat treatment.

how to HEAT TREAT SMALL PARTS

By Michael Kober
President
Commercial Metal Treating, Inc.
Bridgeport, Conn.

WHEN THOUSANDS OF SMALL PARTS must be hardened simultaneously to specification, the problems encountered differ greatly from those associated with handling larger work such as gears, pinions and shafts. The number of variables involved in each batch of work also makes it difficult to prescribe vigorous rules of procedure. Prime considerations, however, must include the geometry of the parts, selection of a furnace, method of furnace loading, furnace atmosphere, heat-treat temperatures and quenching. Each step must be evaluated individually if the parts are to be properly treated.

As can be seen in *Fig.* 1, there is no limit to the variety of shapes, sizes and dimensions of the parts requiring heat treating. Also, the range of steels may start with AISI 1010 and move up to 1.05 percent carbon steels and various types of alloys. Springs comprise the bulk of small part heat treating and the steel for them runs mostly in 0.70-0.80 percent carbon range although there are some applications where 0.30 percent carbon is sufficient.

Heat-treating techniques include gas cyaniding, carburizing and straight hardening. Parts produced

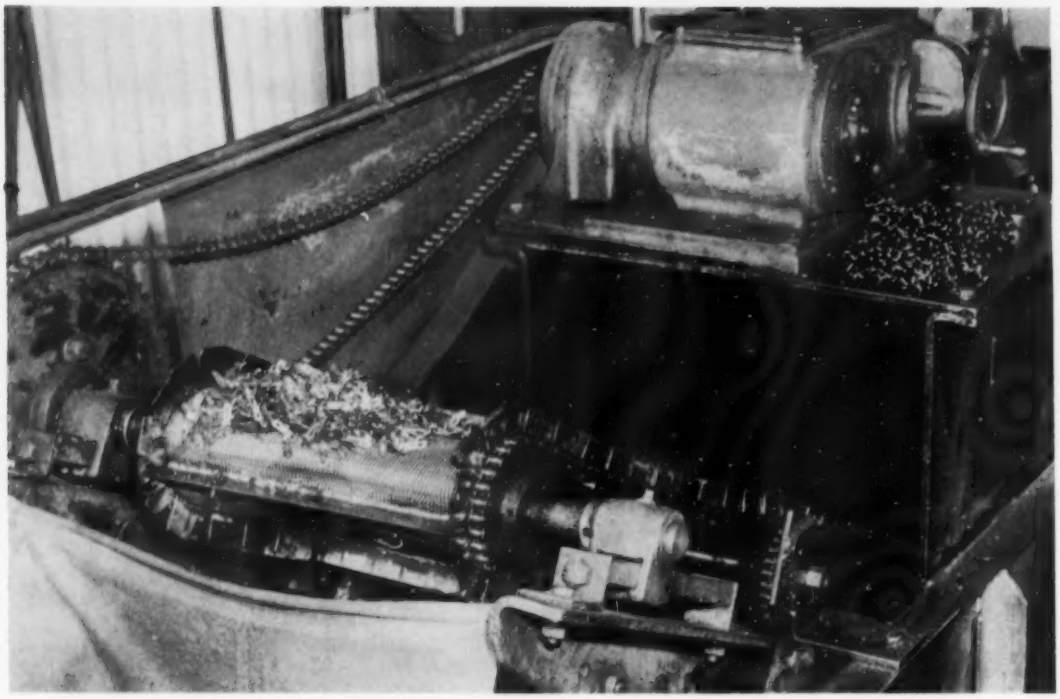


Fig. 2. After being quenched, springs ride up the mesh conveyor and drop into baskets.

from the straight carbon and alloy steels such as AISI 4130 and AISI 4140 have at times been carburized in one furnace and then hardened in another. It is also sometimes more economical to batch carburize, cool under atmosphere and then later reheat in another unit. This situation occurs when parts cannot be quenched in the original heat-treat operation because additional work is necessary on them.

There is endless variety to the heat treating of small parts—for example, some highly specialized stamped and formed nuts require carburizing all the way through to result in a 50 carbon steel, while a standard item like a belt buckle will receive light case hardening (0.003 to 0.005 inch) by means of gas cyaniding treatment.

Selection of Furnace: Three different types furnaces are useful to process small parts—batch, pit and shaker hearth. In both the batch and shaker types, the work is never exposed to the air when transferred into the quench tank; in the pit furnace the work is lifted out and moved through air into the quenching oil, a procedure that affects the surface condition of parts.

Those parts requiring the best surface appearance with minimum discoloration and oxidation (resulting from exposure of hot steel to air), are treated in the batch or shaker furnaces. The superior surface condition reduces the cost of subsequent plating operations by minimizing the amount of cleaning required to prepare parts for plating.

Usually, the product itself is the criterion by which a furnace is chosen. Semifinished pieces lend themselves to the pit method because no finishing is required after heat treatment, but allowance must be made for removing discoloration and oxidation on the surface of the part.

A sizable volume of parts can be handled in an electrically heated three-zone shaker furnace, in which work is fed continuously onto an oscillating bed. There are many advantages to this method: parts can be charged manually or automatically; work is spread over a longer area; regulating the heating rate permits a lighter load to be fed faster; the thinner layer of parts eliminates the possibility of crushing; and quenching is complete since parts drop onto a conveyor, *Fig.* 2, that carries them up through the oil in the quench tank.

Furnace Loading: Because of the wide dissimilarity in their shapes, the loading of small parts depends upon how they will lie in a basket, *Fig.* 3. On a loosely stacked or basketed job where parts will not flatten against one another, there is no difficulty in achieving uniformity of heat and quench throughout the load. But if parts have a tendency to nest, the operator must in each case layer or tier the work so that the lesser quantity of parts will ensure uniformity. Special racks and

fixtures are needed for parts that are long and slender with light cross sections. These cannot be batch loaded because the weight alone could deform them and cause straightening problems.

Only experience enables the heat treater to determine the loading limitations of a batch of small parts in order to get the desired results. In some instances, a certain loading procedure will seem suitable for a certain type of part because of its close similarity to a previous job, yet loading requirements will prove to be completely different.

The hardenability of the material dictates loading procedure. Some parts that appear to be heavily loaded are actually "sponge-like" in that the load is pierced through with countless passageways—other parts are loaded more lightly because they do not readily open themselves up to uniform quenching. About the only formula that seems to work is this—if you think you can get by with a 200-lb load, it is safer to run just 150 lb.

The weight of a load is limited only by the size of the furnace quench tank. In one batch furnace, a 300-lb load can be quenched without difficulty. In another, a 500-lb load is just as easily accommodated. The number of pounds handled depends upon the surface area and density of the parts.

In one particular batch of springs, a 90-lb load was a maximum figure—beyond that there was the possibility of distortion stemming from the weight of parts upon one another. Then again, another batch of flat springs had to be spread lightly and could not be heat treated in a quantity greater than 60 lb. The reason for this was that they were low carbon-steel which lowered their hardenability. An excess of nesting would have resulted in nonuniform quenching of the springs.

One difficult problem centered around an AISI 1010 steel stamping $\frac{3}{8}$ inch square and $\frac{1}{16}$ inch thick. These stampings were nested extremely close. Even though the furnace had the capacity to heat twice the amount involved, trouble would have arisen because of the dense loading and minimum number of holes to pass the carburizing gases. The answer lay in a lighter layer of work in addition to placing low carbon pipes inside the load itself. These 2-inch pipes made it possible to get a definite carry-through of atmosphere from layer to layer.

Furnace Atmosphere: Generally, for small parts, an endothermic generator is preferred. Often, cheaper exothermic-generated gas would be satisfactory, but most heat-treating requirements are critical. On occasion a dissociated ammonia atmosphere in a batch furnace has been used but this method requires careful handling due to the 75 percent hydrogen-25 percent nitrogen combination. Rather than depending on one central endothermic generator, a generator for each type of furnace is used so that a standby is available if needed.

Dew points also vary and depend upon the material being heat treated. In the shaker furnace, a 30-40 degree dew point is held with the endothermic generator using natural gas as the base. A dew point of 30 degrees average will provide all the protection needed for 0.60-0.80 percent carbon.

Quenching Oil: In our operations, two quenching oils produced by Shell Oil Co. are used. They are Temp Oil 23 which is used in the batch and shaker atmosphere furnaces and Voluta Oil 23 in the pit type furnace. Both are well suited to small-part heat treating, especially springs which require an oil capable of quenching out to full martensitic structure. Only the complete hardening of springs will enable them to resist a permanent set in service.

Both oils provide uniformity of quench, true

Fig. 3. A basket load of small nuts is loaded into the batch type furnace in which heating and quenching take place under controlled atmosphere conditions.

Fig. 4. Heating through quenching is automatic in the batch furnace. Here, a basket-load of heat-treated springs is removed after quenching.

hardness to the depth required and minimum drag-out loss. The one difference between them is that in the pit furnaces there is little agitation of oil. Therefore, the high-speed quenching oil (Voluta) is needed to dissipate the heat more rapidly, an important factor when heat treating parts with heavy sections of such steels as AISI 4140, 52100 and 3640. The Temp Oil is also kept at a somewhat higher temperature (130-150 F) in the batch and shaker furnaces in order to reduce the possibility of distortion on some types of springs.

Agitation of the oil in the batch and shaker furnaces (either by propeller or circulating pump) at the time of quenching depends upon the density of the work load. A truly dense load creates a filter action that can restrict the passage of oil. To increase the volume of circulation would only serve to increase the distortion factor on light stampings and springs. The answer lies again in correctly predetermining the loading of parts.

As mentioned previously, work coming out of the batch and shaker hearth furnaces is clean and bright only because heating and quenching take place under a controlled atmosphere, *Fig.* 4. The small amount of discoloration in parts quenched in the pit furnace is due to oxidation in air.

Heating Requirements: The heat-treat temperature is fixed by the steel used—the higher the carbon content, the lower the temperature. Low-carbon steels need a slightly higher range of heat. With springs in the 30-0.90 percent carbon grades, hardening encompasses temperatures from 1450 F to as high as 1580 F. Length of time at heat becomes a matter of density and weight of load. Generally, loads are held at heat from as little as 5 minutes to possibly 20 minutes, depending upon recovery rate of the furnace.

Recovery rate is the ability to return to the desired heat-treat temperatures when a new load of work is inserted. At such times a furnace temperature may drop as much as 50 to 150 F. The recovery rate would then be from 10 to 20 minutes. Since a work load is not heated at the same rate that a furnace recovers, a period of soaking time must be allowed to ensures the proper heating of parts before quenching.

Quality heat treating of small parts is not just a matter of dumping them into a furnace and hoping for the best. There are many factors to be considered, many pitfalls to be avoided. One of the best solutions anyone with small part problems is to test samples and to get the advice of experts.

Composite Technique Helps Casting Jobs

CONVENTIONAL plaster mold casting procedures have limitation because production molds are formed in two sections. Each section must be removed from the patterns intact and without damage to the pattern. This situation restricts castings to shapes that can be divided along a parting line—with neither section containing undercuts.

To solve this casting problem, Atlantic Casting & Engineering Co. has combined plaster mold and investment casting techniques. Portions of a pattern that can not be withdrawn are cast in wax that vaporizes at temperatures lower than 1000 F. The wax portions are attached to a withdrawable portion of the brass pattern; thus, when the mold plaster sets, the brass portions are removed, and the wax is left imbedded in position in the plaster. When the resulting mold is processed through the normal drying cycle, the imbedded wax is vaporized, leaving an accurate cavity as part of the space which forms the finished casting. The drying cycle is a normal part of the plaster mold process, so no extra time is involved in vaporizing the imbedded wax.

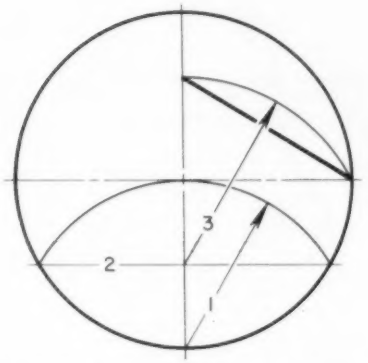
As a result of this composite technique, many castings are being produced that were either impossible or prohibitively expensive to make by cope and drag techniques using conventional coring.

Dividing Circles
into odd-numbered segments

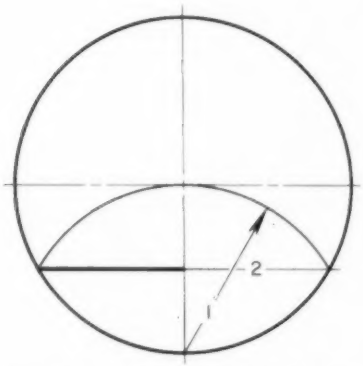
By Y. C. Lee
Consulting Engineer
Taichung, Taiwan

THERE ARE NO PROVEN geometrical methods for dividing a circle into odd-numbered segments of five and above. Approximate graphical methods with sufficient accuracy for most layout and drafting purposes are presented here. *Figs.* 1 through 10 show circles graphically divided into segments of 5, 7, 9, 11, 13, 15, 17, 19, 21 and 23, with 25, respectively. The light construction lines are numbered in the order of the required graphical steps. Required chord length is shown by heavy lines.

The values of the resultant angles obtained by these graphical means have been derived through mathematical calculations and are shown in the accompanying table. They are compared to values obtained by a perfect division. The maximum error, which is eight minutes of a degree, is close to the requirements of most drafting procedures.



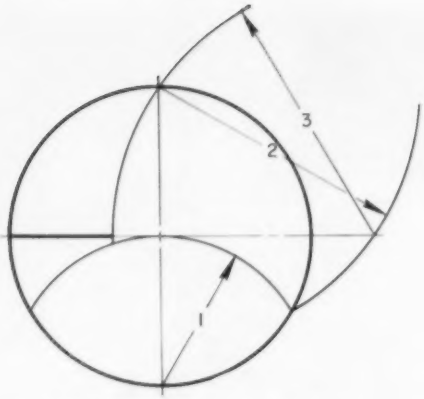
Required chord length for 1/5 division.



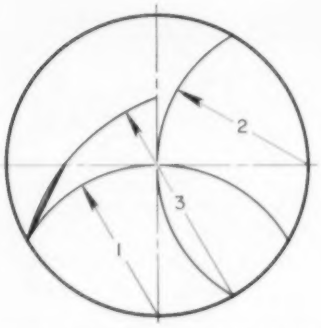
Required chord length for 1/7 division.

Table 1—Calculated Error

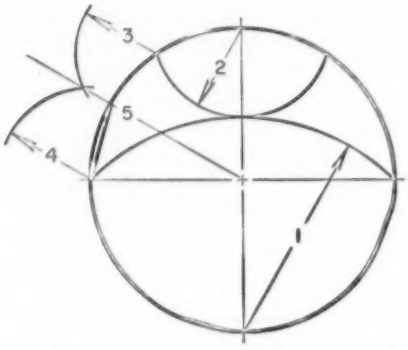
Number of Divisions	Required Chord Length	Actual Required Angle (deg)	Calculated Angle (deg)	Error (Minutes)
5	0.5878 diam	72	72.00	0
7	0.4330 diam	51.43	51.32	6.6
9	0.3410 diam	40	39.88	7.2
11	0.2805 diam	32.73	32.58	8.0
13	0.2383 diam	27.69	27.57	7.2
15	0.2071 diam	24	23.88	7.2
17	0.1830 diam	21.18	21.10	4.8
19	0.1625 diam	18.95	19.02	4.2
21	0.1483 diam	17.14	17.07	4.2
23	0.1355 diam	15.65	15.57	4.8
25	0.1250 diam	14.40	14.37	1.8



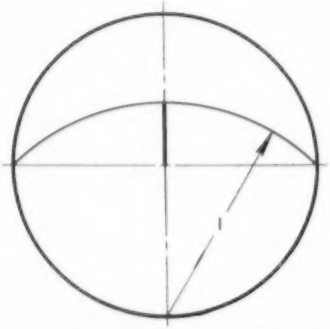
Required chord length for 1/9 division.



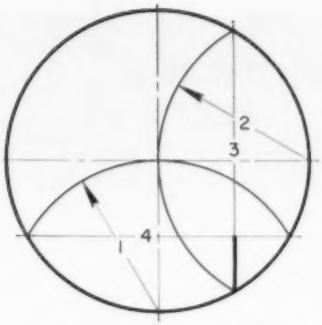
Required chord length for 1/11 division.



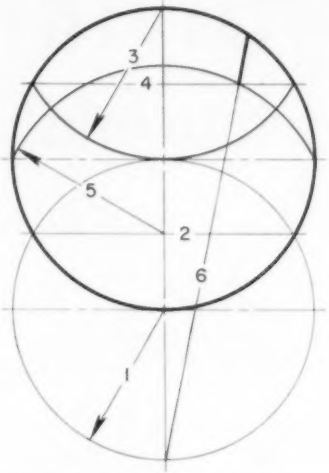
Required chord length for 1/13 division.



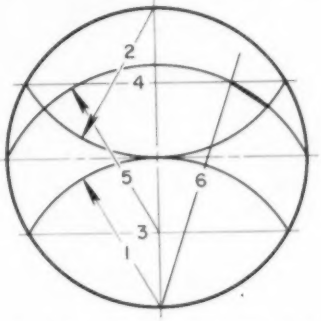
Required chord length for 1/15 division.



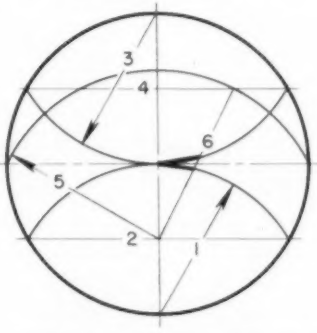
Required chord length for 1/17 division.



Required chord length for 1/19 division.



Required chord length for 1/21 division.



Required chord length for 1/23 and 1/25 division.

ASTE news

Heart Surgeons Seek Engineers' Help..... 88

1959 Honor Award Winners Named..... 91

ASTE Scholarships—Sound Investments..... 94

Annual Report of the President..... 95

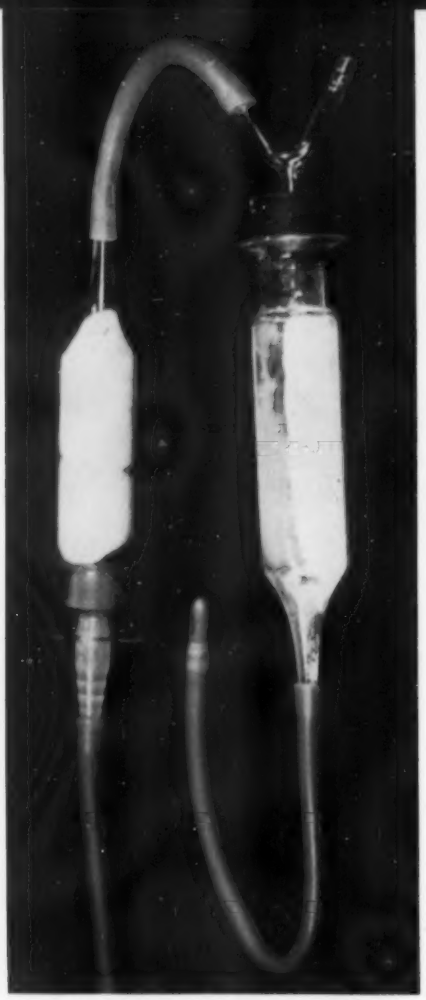
Members in the News.....104

Bonus Issue Due in June.....105

Chapter News and Views.....106

Index of Chapter News.....107

Heart Surgeons



Here's the apparatus used for blowing penicillin crystals and asbestos powder into the pericardial sac to treat certain heart diseases. Doctors say the nozzle has a half-dozen shortcomings—and hope tool engineers can correct them.

TOOL ENGINEERS have been asked to turn their talents from production to pulse beats.

In an unprecedented "affair of the heart" between a medical association and an engineering society, cardio-vascular specialists have enlisted the help of ASTE members in solving mechanical problems that have blocked the long fight against the nation's No. 1 killer, heart disease.

Specific problems in surgical engineering were presented to members of Detroit and Ann Arbor chapters at a medical engineering forum Mar. 16 in St. Joseph Mercy Hospital, Ann Arbor, Mich., held under the sponsorship of the Cardio-Vascular Research Association. Heart specialists at the meeting described tools and equipment required to perform complex medical and surgical tasks which are not now possible or are in need of refinement.

"We're in a hurry," the tool engineers were told by Dr. Clarence E. Crook, president of the medical group and head of cardio-vascular surgical research at the host hospital. "Techniques have outpaced tools in major surgery, so we've decided to ask you for help. We need your engineering brains to come up with ideas and suggestions as to design and manufacture of certain needed devices."

ASTE Member Is Rallying Force

Much of the credit for launching the cooperative venture devolves on Leon DeVos, a Ford Motor Co. engineer and member of Detroit chapter, who was chairman for the medical engineering forum.

Another meeting is scheduled for this month, when progress on the problems will be reviewed, DeVos said. Still other meetings, and possible direct appeals to other chapters, are tentatively planned.

The 84 people, most of them tool engineers, who assembled for the Ann Arbor meeting had come in response to personal appeals by DeVos at chapter meetings for ASTE members to "allow a group of dedicated men to pick your brains."

"You have heard about the mechanical heart, kidney and other spectacular medical mechanical units," DeVos told the chapters. "For each of these better-publicized items, there are hundreds of others that are in use—some, in fact, being used in connection with the larger units. It is with these that help is needed.

"The medical profession is in need of help in an area that their training did not prepare them for, but yours did—engineering."

Because of the vital and urgent nature of the problems, THE TOOL ENGINEER is summarizing some of them for the entire membership of the Society in the expectancy that many will have helpful suggestions in this literal assignment in human engineering. Any offerings will be forwarded to the Cardio-Vascular Research Association, which is a nonprofit organization dedicated to research on diseases and defects of the heart and blood vessels.

Appeal for Ideal Shunt Clamp

One of the most dramatic challenges outlined at the Ann Arbor forum was the shunt clamp problem.

In a newly developed type of heart surgery, the major problem is clamping an artery near the heart

Seek Tool Engineers' Help

by M. L. Stone
news editor

during the operation, which must be performed in three minutes. With the clamps now available, the artery is crushed or else not enough blood is allowed to pass. An artery can be cut or pierced and will heal; crushing, however, causes it to deteriorate and later perhaps prove fatal to the patient.

Edward B. Diethrich and Robert E. Richardson, University of Michigan medical students working under Dr. Crook's supervision, demonstrated for tool engineers the problems involved in their experimental development of the clamps by which blood may be bypassed through plastic tubing around a diseased portion of an artery while the artery is being repaired. This technique, if perfected, would thus allow an indefinite amount of time for the operation.

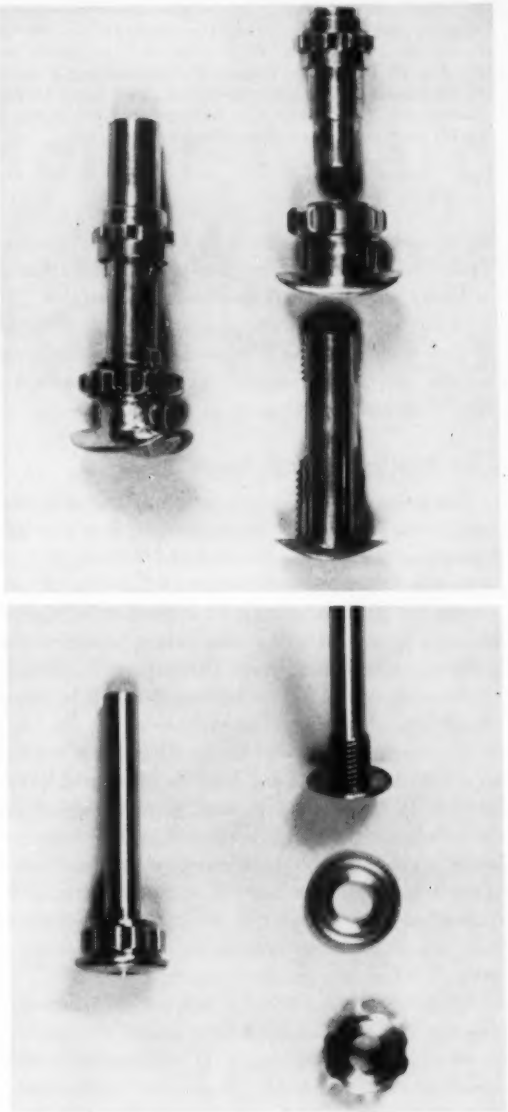
Both Models Have Shortcomings

Photographs accompanying this article show two models of shunt clamps that have been used experimentally. Model #1, which has most of the desired characteristics of the "ideal" shunt clamp that the medical men are looking for, has one major drawback: when the inner and outer shoe (foot pieces) are closed against the artery wall, after insertion in the incision much like a tire valve clamp or a shoehorn, they cause damage to the delicate tissues of the artery and eventual deterioration. To help counteract this, small teeth that will not damage the blood vessel wall were constructed in model #2 of the shunt clamp. But model #2 has the disadvantages of being a flat disk, thus making it difficult to place in the artery; and of lacking the arc (radius) of model #1, thus decreasing the amount of blood which may be bypassed. This last shortcoming is especially vital when the operation is in the vicinity of the heart.

So the shunt clamp problem, in summary, is to place the teeth pictured in model #2 on the oval *contoured* foot pieces of model #1.

Specifications and sketches of the desired clamp can be obtained from the Cardio-Vascular Research Association by anyone who comes up with a valid idea on design or tooling problems.

Dr. Crook himself asked for suggestions on improving a pericardial introducer. (The pericardium is the conical sac that encloses the heart.) The



Model #1 of the shunt clamp (shown assembled and stripped in photograph at top) would work fine, according to the medical men, if the contoured inner and outer shoes had the fine teeth that have been designed into model #2 (shown assembled and disassembled at bottom). That is the medical engineering problem posed by this simple device which clamps into an incised artery near the heart, and shunts blood through tubing around a diseased portion of the artery while the artery is being repaired.

Dr. Clarence E. Crook points out a knotty problem in surgical engineering during the medical engineering forum at Ann Arbor. With him (left to right) are Dr. Joseph D. Morris, Robert Richardson and Edward B. Diethrich, Dr. Crook's assistants; and Leon DeVos, Detroit ASTE member who has sparked the move to enroll tool engineers in medical engineering.

introducer is an apparatus by which a mixture of penicillin crystals and minute particles of asbestos is blown onto the heart to abrade the surfaces. The resulting chronic irritation stimulates the formation of new cross-connecting channels between the blood vessels that furnish oxygen to the heart muscle—thus eliminating the cause of the illness.

Like 'Painting Inside of Icebox'

The general technique, successfully tested in certain cases of coronary heart disease, is much like "painting the inside of a closed icebox with a spraygun," Dr. Crook said. Oxygen is blown through a filter of cotton in a glass tube, thence through a second glass tube which contains the penicillin-asbestos mixture. The oxygen forces this mixture through the special nozzle which is introduced into the pericardial sac.

The so-called insufflation nozzle is on a rubber tube which has a ¼-in. bore through which the powder is blown, and a small bore in which an 8-in. length of 14-gage copper wire has been inserted so that the tubing can be bent into any curve desired to follow the contour of the heart wall in any direction. The end of the tube has a rubber cap with two rather large holes on opposite sides through which the powder escapes.

In the glass reservoir for the penicillin-asbestos mixture, Dr. Crook seeks a new design wherein the powder can be introduced at a hand-controlled speed so that the oxygen can pass continuously through the nozzle, preventing clogging. He also has suggested that if the tube leading the oxygen into the reservoir could be designed to make the oxygen whirl rapidly as it passed through the pick-up chamber, it would keep the crystals and powder in a more uniform suspension. Another possible improvement would be a variable-setting safety valve to reduce oxygen pressure from 30 psi down to a controllable pressure of one to ten psi.

Improvements that Dr. Crook would like to see in the insufflation mechanism include:

- Transparency to permit visual checking of the function of the nozzle.
- Pliability of the rubber tubing, to just the extent where it will be tractable but soft enough not to damage the heart.
- Very smooth inner surface to avert clogging.
- Malleable or flexible characteristics similar to those of a 14-gage copper wire, or possibly a very flexible straight, flat spring which would bend easily in one direction to follow the heart surface and then cause the tubing to straighten out when it was withdrawn from the operative field.
- Material to permit sterilization at 240 F.
- Tip of nozzle 1½ times as large in transverse diameter as tubing would facilitate holding pericardium away from heart surface, making possible more even distribution of the powder on the two surfaces and easier escape of oxygen from the pericardial sac.

Problems With Heart-Lung Machine

Dr. Joseph D. Morris, university assistant professor of surgery specializing in work with the oxygenator, described needed improvements in the "heart-lung" machine which substitutes for the human heart during some types of cardiac surgery.

While employing the heart-lung machine, Dr. Morris said, numerous connections must be made between tubing of different diameters as well as between tubing and various chambers. Some of these connections are subject to relatively high pressures, which increases the possibility of blow-out or broken linkage. Such accidents could have lethal consequences. A positive-action locking device for tube connections is needed.

Again, a problem encountered by Dr. Morris in heart surgery while employing the artificial heart machine is the gradual loss of the patient's body heat as the blood is conducted through the extensive circuit to oxygenate it. All tubing reservoirs and the oxygenator itself are at room temperature when circulation outside the body begins. The best place to rewarm the blood to body temperature would seem to be in the oxygenator itself. A thermostatically controlled resistance heating unit might be placed below the oxygenator and contoured to the barrel shape of the oxygenator chamber where heating of the blood could be accomplished by radiation or conduction, Dr. Morris suggested.

Other problems were presented in written form for the tool engineers' study. Among them were desired improvements in surgical cameras, operating room lights, mouth gags for plastic surgery, and ways to make breathing easier for small children during prolonged surgery.

And still other problems, said the medical men, would be broached to the newly enlisted "medical engineers" at forthcoming meetings.

Honor Award Winners for 1959 Named

A PAST ASTE president, an internationally known industrial leader, two pace-setting chief engineers, and a pair of pioneering educators—this comprises the lineup of winners for the 1959 National Honor Awards. Gold medals and framed citations went to these six men at the Honor Awards Dinner April 18. A seventh award of national stature, the Eli Whitney lecture, went to SWAN E. BERGSTROM.

The medals, adorning plaques with personalized name plates and each representing a specific category in which the chosen has excelled, and the citations, bearing a description of this man's accomplishments, were received by:

ALFRED O. SCHMIDT, winner of the ASTE Gold Medal, for his work in advancing present-day knowledge of metal cutting and machine tools through research and published literature.

KENNETH J. TRIGGER, winner of the ASTE Research Medal, for his precise research and development in the fields of metal cutting, physical metallurgy and machinability of metals.

JACOB J. JAEGER, winner of the ASTE Engineering Citation, for his pioneering in and promotion of numerical control as applied to the metalworking field.

MARK ELLINGSON, winner of the ASTE Education Award, for his instrumentality in setting up efficient engineering curricula, especially cooperative tool engineering courses.

GEORGE ROMNEY, winner of the ASTE Progress Award, for his contributions to this country's welfare by means of better industrial relations and revolutionary ideas of automotive transportation.

T. BERT CARPENTER, winner of the Joseph A. Siegel Memorial Award, for qualities displayed during his tenure as ASTE President and valued service as a tool engineer.

They were chosen by the 1959 National Honor Awards Committee, consisting of Chairman Frank W. Curtis, D. D. Burnside, Robert B. Douglas, Irwin F. Holland, Ray H. Morris, A. M. Sargent, H. L. Tigges, Otto W. Winter, and Jacob J. Demuth.

ASTE
Gold Medal

Alfred O. Schmidt

Chief Engineer, Metal Cutting Research
Kearney & Trecker Corp.

An authority on machinability and thermodynamics of metal . . . has significantly aided in improving machine tool design, tool materials, and cutting fluid applications . . . writings have greatly advanced Tool Engineering on two continents.

ASTE
Research Medal

Kenneth J. Trigger

Dept. of Mechanical Engineering
University of Illinois

Basic researcher in physical metallurgy, metal cutting and machinability . . . developer of an analytical method of determining tool-chip interface temperatures . . . his work is a material contribution to the technology of our times.

ASTE
Engineering Citation

Jacob J. Jaeger

Executive Vice President
Pratt & Whitney Co., Inc.

An acknowledged leader in automation . . . pioneer researcher into servomechanisms and mechanical methods of computation . . . his creative yet orderly approach has been essential to the developing concept of control systems engineering.

Receiving degrees in engineering here and abroad, Dr. Schmidt taught mechanical and production engineering for three years before joining Kearney & Trecker Corp. in 1943. The results of his work as engineer in charge of metal-cutting research are incorporated in the design of new machine tools, especially in regard to power requirements, feed and speed range.

Dr. Schmidt's reports on the metal-cutting science in general have appeared in engineering journals and trade papers in the United States and in nine foreign countries. His ability as a lecturer discussing machine tool developments has gained him international renown. While a member of the ASTE National Technical Publications Committee, Dr. Schmidt headed a group appointed to revise "Machinability" in the *Tool Engineers Handbook*.

Receiving his BSME, his MS and his ME degrees from Michigan State, Professor Trigger returned to the school as an instructor in engineering. Swarthmore and Lehigh have also claimed his services as the same. However, he joined the teaching staff at the University of Illinois as an assistant professor of mechanical engineering. He now holds a full professorship at this same school. His teaching and research experience in physical metallurgy, production engineering, metal cutting, and machinability have qualified him as expert in these fields.

Along with his teaching duties, Trigger is a consultant on metal cutting. Many published reports have resulted from his research. Besides his membership in the ASTE, he also belongs to the ASME, ASM and the ASEE.

Jaeger's title as chief engineer is one that encompasses work in mechanical, hydraulic, electrical, electronic, and production engineering fields. He refers to this package as "control systems engineering." While at M.I.T. in the 1930's he explored the numerical controls idea and has been promoting and perfecting it ever since. He was the man behind Pratt & Whitney's entry into the field of numerically controlled machine tools.

He began this process slowly with the development of numerically controlled jig borers and grinders, but hopes to apply it some day to all of industry, feeling it will lead the way to more accurate, faster and cheaper production methods. This "engineers' engineer" is frequently called upon to prepare papers for technical sessions.

Acquiring his education from the universities

ASTE
Education Award

Mark Ellingson

President
Rochester Institute of Technology

Constructive administrator in engineering education . . . sponsor of outstanding curricula for cooperative Tool Engineering courses at junior and senior college levels . . . has greatly aided the development of competent Tool Engineers.

ASTE
Progress Award

George Romney

Chairman & President
American Motors Corp.

Gifted organizer and respected leader in major industry . . . a builder of men and outstanding exponent of friendly industrial relations . . . his concept of automotive transportation is a definite contribution to the American economic welfare.

Joseph A. Siegel
Memorial Award

T. Bert Carpenter

President
Bert Carpenter Co.

Past president, prime organizer, and leading spirit in the Society's early development . . . greatly strengthened ASTE professional position . . . a true Tool Engineer, continuously offering valued service and wise counsel at all levels of Society operations.

of Rochester and Ohio State, Dr. Ellingson has held scholastic teaching and administrative positions since 1926. Also the author of several books and articles on pedagogy, he is best known for his efforts in setting up exceptional lab facilities for engineering students at the school which he heads.

The Rochester Institute of Technology's precision measurement lab and machine tool lab are among the best in the country. The school was one of the first colleges or universities in the country to offer, in 1945, a course in tool engineering. R.I.T. instituted it as one of the three majors of a three-year cooperative engineering program. Students in the program were granted Associate in Applied Science degrees and, if they wished, could earn a B.S. after two more years of study.

When American Motors Corp. was formed in May, 1954, through a merger of Nash-Kelvinator Corp. and Hudson Motor Car Co., Romney became executive vice president and a member of the board of directors of the new company. On Oct. 12, 1954, he was elected to his present position.

Born in Mexico of American parents, Romney attended Latter Day Saints University, University of Utah and George Washington University. In 1929 he served as a tariff specialist, the following year joining the Aluminum Company of America. He went to Detroit in 1939 to work for the Automobile Manufacturers Association. His position with them was supplemented by one as organizer and managing director of the Automotive Council for War Production. He also helped create the Automotive Committee for Air Defense just before World War II. After the war he developed postwar programs of the International Labor Office.

Carpenter is best remembered for his term as third ASTE president during a period when the first wave of enthusiasm that had brought the Society into being was somewhat quelled by the depression. His great simplicity, humor and enthusiasm, however, carried over into his Society activities and infected everyone who met him.

With his acceptance of the presidency, Carpenter determined to strengthen the internal organization, raise the standard of membership requirements, develop speakers and leaders within the membership, and split up the executive responsibility. During his year of office—a year Carpenter called "The Stormy Year"—more progress was made than in almost any year since.

ASTE Scholarships— Sound Investments

THE AWARDING of scholarships is similar in many ways to investing in stocks. Both undertakings expend funds for future security reasons and both take a while to pay off. In one way, however, they differ: that is in the risk involved. Buying stocks is a venture which, though it requires a study of the market, always carries with it the hazard of financial disaster. Awarding ASTE scholarships also requires a study of the "market"—students who are prospective tool engineers—but the risk is much less.

The students are screened thoroughly, their needs are weighed and their instructors are questioned as to the applicants' academic ability. After such intensive research the risk is practically eliminated, 20 young men are assured a year's financial backing for their education and the tool engineering profession has added 20 exceptional candidates to its ranks.

This year ASTE International Education Awards have gone to a lineup of outstanding students from colleges, universities, junior colleges, and technical schools across the nation. Chosen by means of applications, personal letters, and faculty recommendations, the winners all rank among the best in their class. They are respected by teachers and fellow students alike. Their interest in tool engineering is such that they intend to pursue courses in this field, or one at least closely related to it.

But all the respect, interest and ability in the world won't allow a student to follow a course of study if he is without the required funds. It is just this factor that prompted the institution of the scholarship program. Many of the winners would be unable to continue their formal education were it not for this financial assistance. Among this years' winners are several who maintain full-time jobs along with a full schedule at school. The scholarships will not only enable them to cut down on their job hours, but will also grant them the opportunity to devote more time to their studies.

Totaling $11,000, the awards will be divided into sums of $700 each for the winners attending four- or five-year colleges and universities, and $400 each for those at junior colleges and technical schools. Up until last year the two-year schools had been excluded from participation in the program, but when it was announced that they too might compete, the response was so overwhelming that it was decided to establish their permanency in the setup.

Receiving the education awards for $700 are:

Raymond Ambrogi—Massachusetts Institute of Technology
John Beusch—Rochester Institute of Technology
Herb E. R. Brown—University of Toronto
Curtis Druckrey—University of Wisconsin
Don J. Flickinger—University of Arizona
Edward Kearney—Northeastern University
George McGowan—Purdue University
Roland Paul—Syracuse University
Donald Plane—University of Cincinnati
Robert Zimmer—University of Illinois

Receiving the awards for $400 are:

Edward Cerkowski—Hudson Valley Technical Institute
Louis Gass—Mohawk Valley Technical Institute
Robert Firmery—State University of New York
John Krzyzewski—Pennsylvania State University Extension
Robert Melloni—Franklin Technical Institute
Harvey Melohn—Pasadena City College
Douglas Mitchell—Hamilton Institute of Technology
Ralph Morris—Sinclair College
Theodore Tomaszewski—Pennsylvania State University Extension
Frank Whisnant—Gaston Technical Institute

As recipients of the International Education Awards the students will be expected to maintain their high scholastic averages and, of course, direct some of their attention toward tool engineering or its related fields. It is true that many of the schools represented do not offer tool engineering courses specifically. With the ever-increasing number of institutions adding these courses to their curricula, however, a few of the winners' schools are bound to be affected. For students in the junior colleges the matter will not be too difficult. They can, if they decide to pursue studies in tool engineering, choose a four or five-year school which offers same in order to complete their education. If, with the aid of these scholarships, even a few of the winners develop a sincere interest in tool engineering, the ASTE will know its market analysis has been a success and its funds have been invested soundly.

american society of tool engineers

1959 ANNUAL REPORT

156 Society Chapters serve strategic industrial areas

ASTE CHAPTERS

1. Detroit
2. Racine
3. Cleveland
4. Milwaukee
5. Chicago
6. Fairfield County
7. Hartford
8. Pittsburgh
9. Toledo
10. Buffalo-Niagara Frontier
11. Twin Cities
12. Rockford
13. Baltimore
14. Northern New Jersey
15. Philadelphia
16. Rochester
17. St. Louis
18. Dayton
19. Syracuse
20. Schenectady
21. Cincinnati
22. Central Pennsylvania
23. Tri-Cities
24. Elmira
25. Worcester
26. Toronto
27. Los Angeles
28. Golden Gate
29. Houston
30. South Bend
31. Peoria
32. Springfield (Mass.)
33. Boston
34. Greater New York
35. Binghamton
36. Columbus
37. Indianapolis
38. Western Michigan
39. Seattle
40. Twin States
41. New Haven
42. Hamilton
43. Nashville
44. San Diego
45. Fond du Lac
46. Portland (Maine)
47. Akron
48. Potomac
49. Williamsport
50. Montreal
51. North Texas
52. Wichita
53. Little Rhody
54. Louisville
55. Windsor
56. Fort Wayne
57. Kansas City
58. Decatur
59. (Inactive)
60. New Orleans
61. Atlanta
62. Erie
63. Portland (Oregon)
64. Springfield (Illinois)
65. Niagara District
66. Richmond
67. Phoenix
68. Saginaw Valley
69. Oakland County
70. Muncie
71. Cedar Rapids
72. Fox River Valley
73. Evansville
74. Mid-Hudson
75. Madison
76. Springfield (Ohio)
77. Denver
78. Mohawk Valley
79. Ann Arbor Area
80. Des Moines
81. Grand River Valley
82. Piedmont
83. Lehigh Valley
84. Long Beach
85. Salt Lake City
86. Granite States
87. Jackson
88. Long Island
89. Greater Lancaster
90. Tulsa
91. London-St. Thomas
92. Los Alamos
93. Albuquerque
94. Peterborough
95. San Gabriel Valley
96. La Crosse
97. Lima
98. Santa Clara Valley
99. San Fernando Valley
100. Northern Massachusetts
101. Keystone
102. Paterson
103. Nebraska
104. Louis Joliet
105. Memphis
106. Tucson
107. Knoxville-Oak Ridge
108. Chautauqua-Warren
109. Lansing
110. Canton
111. Muskegon
112. Calumet Area
113. Merrimack Valley
114. Hendrick Hudson
115. Western Reserve
116. Kalamazoo
117. Battle Creek
118. Southeastern Massachusetts
119. Santa Ana Valley
120. Benton Harbor-St. Joseph
121. San Antonio
122. Riverside
123. Little Rock
124. Monadnock
125. Oklahoma City
126. East Texas
127. Ashtabula County
128. Northwestern Pennsylvania
129. Centinela Valley
130. Monmouth
131. Elkhart-Goshen
132. Schuylkill Valley
133. Raleigh-Durham
134. Lorain County
135. Mansfield
136. Ottawa
137. Kokomo
138. Trenton-Delaware Valley
139. Ozark
140. Southeast Kansas
141. Mississippi
142. Macomb County
143. Birmingham
144. Sydney, Australia
145. Sacramento, Calif.
146. North Shore, Boston, Mass.
147. San Francisco, Calif.
148. Central Connecticut
149. Greater Harrisburg
150. Southeast Florida
151. Catskill Region
152. Melbourne
153. Santa Monica Bay Area
154. Lexington
155. Bristol, Tenn.-Va.
156. Ogden, Utah

ASTE STUDENT CHAPTERS

University of Michigan
Utah State College
University of Kansas
Wayne State University
Alfred State Technical Institute
Purdue University
Wentworth Institute
Franklin Technical Institute
City College of New York
Mohawk Valley Technical Institute
Lawrence Institute of Technology
California State Polytechnic College
Canton Ag. & Tech. Institute
University of Wichita
Long Beach City College
Southern Technical Institute
Hudson Valley Technical Institute
Rochester Institute of Technology
Oregon State College
Sinclair College
Erie Co. Technical Institute

Fellow Members of ASTE:

The past year was a momentous one in the field of engineering. It saw man sometimes failing, but sometimes spectacularly succeeding in sending his first probes into outer space; it saw him making great strides toward harnessing and exploiting new sources of energy; it saw him tackling with renewed vigor the old sore spots of social, political, and economic imbalance on his own planet. In countless ways, some revolutionary, some evolutionary, the world progressed because of the products of engineering skill.

Your Society, and *you*, played no meek role in all this. The ASTE continued to grow and to render service—service to its members, to the tool engineering profession, to industry, and to mankind. It faced up to the task of adapting itself to meet new challenges; and even now the leaders of your Society, the board of directors, are deeply occupied in critically examining every past and present aspect of the ASTE and planning for the future.

Your Society leaders have placed most emphasis on education during the past year, for education is rightfully assuming preeminent value to the individual citizen and the nation. In our own field, an ever-increasing interest in tool engineering education is being exhibited by colleges and universities. Also, an ever-increasing interest in self-education is being shown by our members, as evidenced by the growing attendance at on-campus conferences and seminars.

In this annual report of your president are summarized the activities of the various national committees. Although such presentations do not do justice to the fine contributions of these active groups, this report should help give you an idea of the Society you're a part of. I commend it to your reading.

COST OF SERVICE PER MEMBER PER YEAR*

(based on fiscal years 1956-57 and 1957-58)

Scientific & Engineering Expositions	$ 3.25
Conferences on Science & Engineering	1.46
Reference Publications on the Science of Tool Engineering	1.89
Periodical Publications on the Science of Tool Engineering	25.83
Engineering and Educational Research	1.13
Engineering Regulatory Research	.19
Engineering Data Service	.84
Technical Information Services	1.26
Scientific & Engineering Program Planning	.96
Standards Research	.91
Awards for Science, Engineering, Research	.20
Operations (Office; Finance, Judicial, Constitution & Bylaws activities; officers and directors)	7.52
Membership Activity	.79
Total	$46.23

INCOME PER MEMBER PER YEAR

(based on fiscal years 1956-57 and 1957-58)

Scientific & Engineering Expositions	$ 8.84
Engineering Data Service	.81
Reference Publications on the Science of Tool Engineering	.46
Periodical Publications on the Science of Tool Engineering	29.24
Conferences on Science & Engineering	.53
Dues (Includes Member Subscription)	6.57
Initiation Fees & Miscellaneous	1.55
Total	$48.00

*Average membership during the period was 38,426

The strong financial structure of the Society, with a net worth of $1.4 million, is portrayed in the balance sheet at the top of the next page.

The above figures for income and expense illustrate the multiple dividends each member receives in addition to invaluable technical and scientific information. With an average dues payment of $6.57 going to Headquarters (a portion of the original outlay for dues goes back to the chapters), each member receives services in various forms from the Society amounting to $46.23, a return ten times that of his investment in National operations.

Society research expenditures are not represented above because they were drawn from ASTE allocations of the previous year, augmented by funds provided from industry.

BALANCE SHEET FEBRUARY 28, 1959

ASSETS

Cash	$ 152,936.92
Treasury Bills	149,603.25
Accounts Receivable	33,758.42
U.S. and Canadian Government Bonds	470,772.00
Investment Funds at Cost	358,803.64
Inventories	100,380.72
Property and Equipment	209,574.40
Expenses Paid in Advance	8,367.58
	$1,484,196.93

LIABILITIES AND NET WORTH

Liabilities	
Unpaid Normal Expenses	$ 25,921.96
Deposits—Future Business	17,544.64
Accrued Personnel Expenses	2,453.41
Unpaid Sales Commissions	1,798.50
Special Award Deposits	2,245.00
Total Liabilities	$ 49,963.51
Net Worth	1,434,233.42
Total Liabilities & Net Worth	$1,484,196.93

Finance: The Society's ability to serve its members is dependent upon the state of its finances. The National Finance Committee carefully studies the assets and liabilities, reserves, income and expenses, in its attempt to safeguard and bolster the soundness of the ASTE's financial structure. Under a new budgeting procedure approved by the Board at the 1958 semiannual meeting, the finance committee prepares a total budget for each facet of the Society for the forthcoming fiscal year.

The balance sheet reproduced in this report, showing a net worth of $1.4 million, reflects the Society's solid financial footing despite past months of economic recession. The accompanying tables for income and expense are represented on a per-member basis, covering the two preceding fiscal years in order to average the biennial Tool Show on an annual basis.

Professional Development: To make more apparent this committee's goal of encouraging the professional growth of the tool engineer whether he becomes registered or not, the Board of Directors has changed the name from the National Professional Engineering Committee to the National Professional Development Committee.

Included in the committee's activities are collecting and disseminating professional engineering information to chapters and members, and encouraging the establishment of refresher and preparatory courses for members.

ASTE is now an associate member of the National Council of State Boards of Engineering Examiners. Aside from participation in the council's regular meetings, the Society through its committee was represented this past year at a special meeting to explore proposed revisions to the existing "model law" for professional registration.

Programs: The major objectives of the National Program Committee for the past year have been to improve programs at the chapter level; to improve and expand national meetings; and to improve the collected papers. Among ways of achieving these ends have been the annual regional program clinics, held in the spring for the new chapter program chairmen in each of 14 zones throughout the United States and Canada; distribution of the annually revised Speakers Directory and the biennial Outstanding Speaker Bulletin; and provision of emergency programming material to chapters in this country and Canada.

The first ASTE-ASME exchanges of technical papers took place at the ASME annual meeting in New York City in December and at the ASTE convention in Milwaukee.

In addition to planning the Milwaukee Annual Meeting with its 13 technical sessions and 11 plant tours, this committee has been working with the St. Louis Host Committee on plans for the Semiannual Meeting there in October. Twelve technical sessions and three plant tours have been scheduled, along with a St. Louis Day Dinner to inaugurate the meeting. In addition, preliminary work has been instituted to interest members of Detroit area chapters in promoting the 1960 Convention and Tool Show.

Industrial Exposition: The ASTE's tool shows take a back seat to no other exposition staged in this country for interest, for educational value, for technological scope, and for sheer spectacle. Conducted biennially in the past and planned annually beginning in 1960, these expositions keep tool engineers and the various facets of industry they represent abreast of the newest production methods. The 1958 tool show in Philadelphia last May, with its challenging theme of "Tooling for Competition," drew some 500 exhibitors and 32,000 visitors. A second success of the year was the Western tool show in Los Angeles last fall.

A National Exposition Committee, set up at the beginning of 1958, has as its perennial objective to keep the tool show the finest in its field. To achieve this objective, the committee will continue to establish broad policies and seek out fresh ideas and methods to provide a market place for the newest machines, tools, and equipment, and a forum for the newest ideas.

The committee has recommended that dates for the 1960 Detroit Tool Show be April 21-28, and that the 1960 Western Tool Show be Nov. 14-18.

Standards: This committee represents the Society in all standards activities of other national and international organizations. The ASTE is a member of the American Standards Association, Canadian Standards Association and the Standards Association of Australia. The Society is also cooperating in formulating standards with 14 other technical societies in this country.

The Society sponsors two sectional committees, cosponsors two others and has representation on ten additional sectional committees. At this writing there are 42 chapters engaged in initiating new standards on items where no standard now exists. As of Dec. 31, 1958, there were 98 chapters reviewing standards pertaining to tool engineering.

In the past year the National Standards Committee published the first ASTE standard, Diamond Dressing Tools. This standard is receiving acceptance the world over.

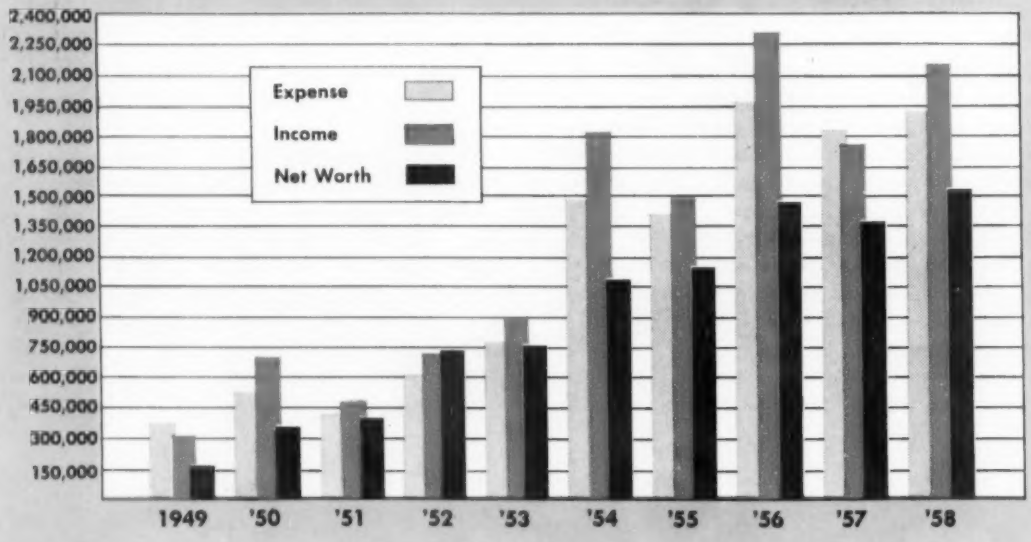
The committee continues to be a centralizing force, coordinating and correlating standards work of hundreds of companies, individuals and associations to prevent duplication of effort and to bring together all interested parties.

Technical Publications: This seven-member committee is planning to enter the tool engineering textbook field, and will add an educator to the committee as policy supervisor of the program.

The group held three regular meetings during the past year, along with several special meetings in conjunction with its various book-building projects.

The Tool Engineers Handbook, Second Edition,

OUR GROWTH at



a monumental collaborative effort by 405 experts in the field, is expected to be off the press in the early fall. A lower-priced text edition for students will appear simultaneously. Some 75,000 copies of the first edition of the *Handbook* have been sold throughout the world.

Arrangements have been made for a Polish-language edition of the *Die Design Handbook*, over 19,000 copies of which have been sold since its American publication in 1955.

Preparation of a handbook of process planning and estimating and of a book on jig and fixture design is progressing. Other books in active preparation are on machining with carbides and oxides, numerical control of machine tools, and aircraft and missile assembly tooling.

Tooling for Metal Powder Parts, by George H. DeGroat, was published for the ASTE during the past year. Since its introduction at the 1958 Tool Show it has received very favorable reviews.

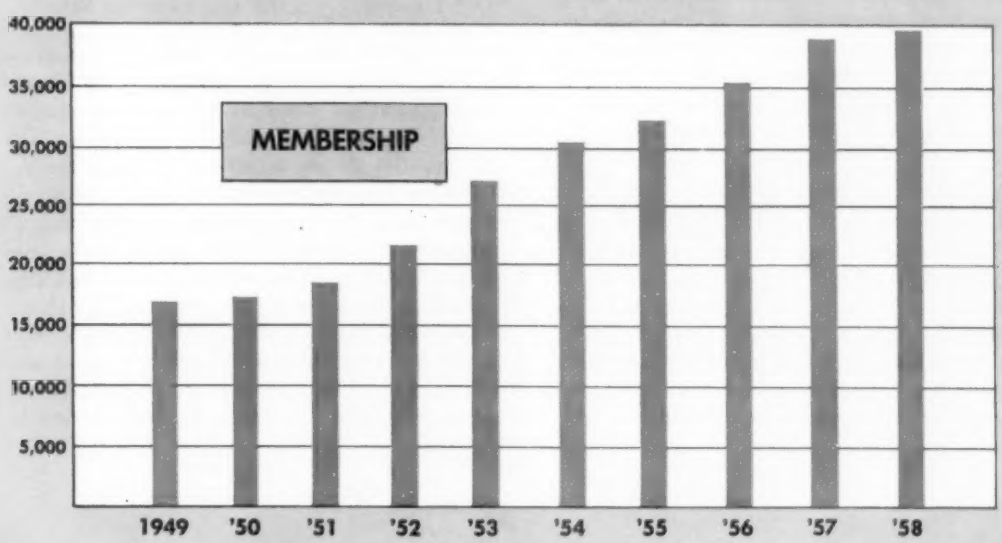
Education: The ever expanding programs fostered by the National Education Committee have as their objective not only to help the student tool engineer but also the man on the job; not only the young but the old; not only the member but the non-member. The goals of the committee, in short, hew closely to the fundamental purpose of the Society—disseminating knowledge in the science of tool engineering.

Believing that education is the most vitally needed contribution to the well-being of this nation and its individuals, your Society has this past year taken major steps to broaden its own educational services. Among them:

- Nine creative manufacturing seminars, designed to present the latest information on production methods and held in major industrial centers.
- Assistance to chapters in planning, organizing and staging advanced tool engineering practice series in three chapter areas, and on-campus conferences at a half-dozen major universities and colleges.
- Development and pilot presentation in two chapter areas of a course on cutting dies.
- Development of suggested two and four-year tool engineering curricula and, through both national and chapter efforts, encouragement of more and more schools to set up tool engineering programs.
- Publicizing the importance of tool engineering education through brochures and career booklets, such as *The Need for Tool Engineering* and *Adventure into Tomorrow.*
- Continuing the annual International Education Award program, with 10 university-level scholarships and 10 technical institute and junior college scholarships being offered to needy qualified students.
- Increased help for and contact with student chapters.

A special report will be forthcoming from this national committee on a study of textbook needs for a tool engineering curriculum.

a glance 1949—1958



Membership: The Society is proud of its members, both from the aggregate and the individual perspectives. Being a voluntary association of free men under a democratic constitution, it has never lost sight of the fact that its lifeblood is its members. Even though it is divided into national, chapter, and committee jurisdictions, the Society is in the final analysis oriented to the individual member. He *is* the Society.

Perhaps due in large measure to this emphasis on the individual member has been the phenomenal growth of the ASTE in the 27 years of its existence. A total membership that has just topped 40,000 places our Society in the ranks of the largest engineering groups in this country.

National charters have now been granted to 156 senior chapters in the United States, Canada and Australia. A list of chapters accompanies this report. During the past year the following senior chapters have been chartered: Greater Harrisburg; Southeast Florida; Catskill Region (Kingston, N.Y.); Melbourne, Australia; Santa Monica Bay Area; Lexington, Ky.; Bristol, Tenn.-Va.; and Ogden, Utah.

In addition, there are 21 student chapters on the campuses of leading educational institutions across the country. Two of these, Sinclair College and Erie County Technical Institute, were chartered this past year; and at this writing charters have been approved for student chapters at two more schools, Pasadena City College and State Technical Institute in Hartford, Conn.

We have lost some members. In fact, nonpayment removals during the last year have been the highest in recent years. Despite this, the Society has shown a net increase in membership of almost a thousand over last year. It is the National Membership Committee's opinion that forthcoming months should show a considerable drop in the average of nonpayment removals from the rolls, as well as membership increases approaching prerecession figures. The committee's optimism is based on the general upturn in the nation's economy.

Editorial: Highlighting the year's activities of the National Editorial Committee and the staff of THE TOOL ENGINEER magazine has been the planning and preparation of a 13th issue, due to be published June 15, 1959. This new service to the membership will be the Suppliers Directory Issue, which will contain 1000 headings and some 20,000 listings in the product section and up to 10,000 local outlets in the unique sales office section.

Periodic and impartial readership surveys indicate that THE TOOL ENGINEER is growing in readership, prestige and member acceptance.

Simply stated, the objectives of this committee and the magazine staff are to continue giving ASTE members the best technical magazine in the field, the best possible news service to all local chapters, and the best and most informative package for the individual member. Among steps taken in the continuous process to upgrade the magazine might be mentioned: plans for another gadget contest among members; the first use of four-color process reproduction in the magazine's pages; inception of a monthly news trend page titled "Looking Ahead"; and an attempt to improve the quality of news being submitted and to make that news interesting to all chapters.

Public Relations: The activities of this committee and its operating arm, the Information Services Department, are aimed at maintaining the Society's good reputation and at encouraging a better understanding of tool engineering.

A special effort was made this year to create a greater familiarity and awareness of the over-all public relations job at the chapter level. Some of the projects completed were:

- A revised chapter public relations kit.
- Monthly PR memos published in *Scope*.
- Three new color sound-slide films.
- Distribution of the new portable display kit.
- Model TV program script distribution.
- Prepared talk for chapter PR use.
- Chapter bulletin editor aids (bulletin survey, check list and idea scrapbook).
- Publication of three new booklets—*A Better Life Through Creative Manufacturing; Adventure into Tomorrow;* and *ASTE, Your Career and You.*

On both the local and the national level an increasing flow of information about the ASTE and its activities was noted in the newspapers, trade press, radio and television.

Honor Awards: Six national honor awards, the third annual Eli Whitney lecture award, and 14 chapter-level Award of Merit plaques have been presented during the past year by this committee.

The national awards, conferred at the Honor Awards Dinner of the Milwaukee convention, went to the following: George Romney, chairman and president, American Motors Corp., Progress Award; Alfred O. Schmidt, chief engineer, metal cutting re-

search, Kearney & Trecker Corp., Gold Medal; T. Bert Carpenter, president, Bert Carpenter Co., Joseph A. Siegel Memorial Award; Jacob J. Jaeger, executive vice president, Pratt & Whitney Co., Engineering Citation; Mark Ellingson, president, Rochester Institute of Technology, Education Award; and Kenneth J. Trigger, department of mechanical engineering, University of Illinois, Research Medal. Chosen as the Eli Whitney lecturer was Swan E. Bergstrom, president, The Cincinnati Milling Machine Co.

Setting up of an award for authors of the best technical papers presented at national meetings of the Society, as suggested by the National Program Committee, is under advisement by the NHAC. This committee has recommended to the Board of Directors that all ASTE chapters establish honor awards committees, for the purpose of handling nominations for the Award of Merit and other honors.

Judicial: Nine past presidents make up this committee which has the authority to render final decisions regarding interpretations of the National Constitution and Bylaws Committee, in cases where the decisions of that committee are not accepted.

Research: The ASTE Research Fund Committee is comprised of 11 industry leaders, plus the Society executive secretary and the research director. With funds augmented by contributions from industry, the ASTE research program strives to contribute outstanding and worthwhile information to the science of tool engineering, and to the American way of life.

During the past six months, the Research Fund has issued seven research reports (Nos. 15 through 21), including the significant "Evaluation of the Present Understanding of Metal-Cutting." This 275-page report on the present applications and theories of metalworking, a two-year project by the Battelle Memorial Institute, is considered a major contribution to research in the field.

Attempts of the steering committees to raise sufficient funds to carry on the various research activities were only partly successful. At its last meeting, the main committee gave careful consideration to ways and means of raising funds for support of ASTE-sponsored research. The group also voted to organize two subcommittees to furnish guidance on future areas of investigation. One of these committees represents the thinking of the practical engineer and the other the thinking of the Ph. D. type of mind.

Progress: Evaluation of Society operations on all levels in relation to the over-all objectives of the ASTE, and recommendations for improvement of these operations, is the job of the Progress Committee. During the past year the group has given much study to such proposals as regional councils and decentralized leadership conferences. It has also been weighing the feasibility of establishing the office of Chairman of the Board. The committee assists other national committees in thinking of the future and in making long-range plans.

Constitution and Bylaws: This six-member committee has rendered interpretations during the past year on various questions of law and procedure for 11 senior chapters and one student chapter, and also for a number of individual members.

The committee has also processed three petitions for amendments to the Constitution, two of which the Society membership approved in referendum ballots. The approved amendments extend the president's term of office as a director and clarify student member qualifications.

Conclusion: Surely the foregoing shows that a sincere effort has been made by all concerned to operate the Society with integrity and courage. Coordination and cooperation among committees and Headquarters personnel have contributed substantially to our progress.

It is believed that the long range planning studies now in progress by the Board of Directors will prove of inestimable value to the future of the Society. I feel sure that my successors will complete the job and share in its benefit to the Society.

Again I would like to stress the importance of the chapters, the foundation stones of our Society. Their autonomy and the individual support of their members are the true sources of our strength. By continuance of better communications and our Leadership Conferences we should look forward to increasing their success and loyalty.

It has been a great honor to serve as president of this Society. I am grateful to all of you who have made my responsibilities lighter and aided in our progress during the past year.

Submitted for and on behalf of the Board of Directors and National Officers

President and Chairman of the Board

Members in the News

DAVID A. SCHROM, national secretary in 1957 and presently vice president and director of the ASTE, has been named works manager for the Grantley Works of the York Div. of Borg-Warner Corp.

Schrom began full-time work for York upon his graduation from Penn State in 1942, with a B.S. degree in industrial engineering. He served in various capacities until 1957 when he was promoted from plant superintendent to general plant superintendent, the position he held until the new appointment.

A registered professional engineer in the state of Pennsylvania, Schrom is past chairman and member of the Professional Engineering Committee of York Chapter #22, ASTE.

EARL S. GODARD, Racine, has been appointed to the position of vice president and general manager for the Badger Tool Works, Inc. Godard brings to the company 28 years of tool and die experience, beginning at the Chevrolet Motor Car Co. of Flint, Mich., and later with Bendix Aviation Corp., Trane Co. and Carrier Corp. . . . After three years in carbide development and service capacities for Wesson Co., WILLIAM GERMANI, of the Detroit chapter, has been named field sales and service engineer. . . . ANTHONY ROGERS, immediate past chairman of the Detroit chapter of ASTE, who joined Wesson in 1950, has been advanced from district supervisor to district manager. . . . Announcement has been made of the appointment of ALFRED J. CHANDLER to vice president of the Brush Div. of the Osborn Mfg. Co. Chandler joined the Osborn organization in 1950 as sales engineer, later became sales manager. . . . GLEN H. STIMSON, who has been gage sales manager and chief engineer of the gage division since 1944, has been appointed chief engineer of the Greenfield Tap & Die Div. of United-Greenfield Corp. Stimson was a member of the committee representing the United States at the International Standardization Organization meeting last year in Europe. He is a member of the Northern Massachusetts chapter. . . . Leland Gifford Co. has announced the promotion of STANLEY B. DOWD from vice president to president. Dowd has been a member of the Worcester ASTE chapter since May, 1937.

Godard

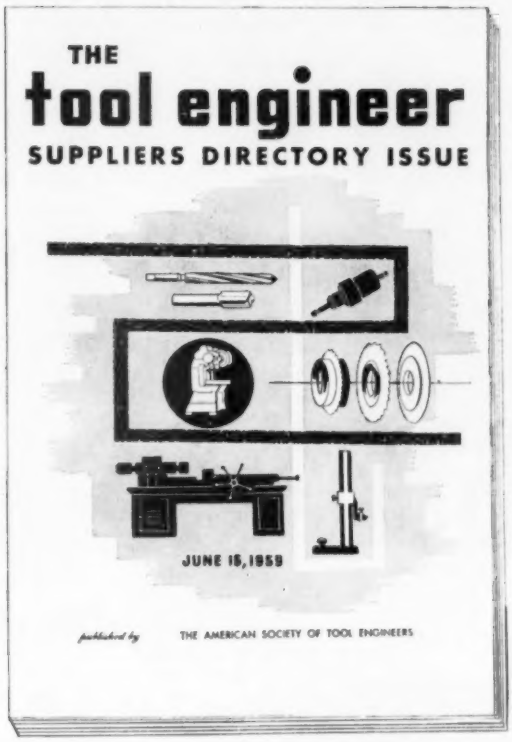
Chandler

Messler

RICHARD W. DOW, Phoenix chapter member, has formed the Dow Machine Tool Co. to represent the George Gorton Machine Co. and Burg Tool Mfg. Co. in the state of Arizona. . . . ROBERT A. HARDIN, who joined Denison Engineering Co. in 1954, bringing with him a wide range of experience in the oil hydraulic field, has been transferred to Los Angeles to serve customers in that area. . . . B. VON MAYRHAUSER, Boston, after many years' experience in the electronics and plastics field, has been appointed general manager at Baird-Atomic, Inc.

WILLIAM C. KUNKELMAN, Cincinnati member, who has for a number of years served as southeastern district manager, has been appointed Pacific regional manager for The Carpenter Steel Co. . . . ERIC G. MESSLER, Paterson chapter, has been elected vice president and assistant general manager of Sandvik Steel, Inc. Messler has been associated with Sandvik in the United States since 1955, having been vice president of Sandvik Canadian, Ltd., Montreal, for six years. Prior to this connection, for ten years he was associated with the parent company, Sandvikens Jernverks Aktiebolag in Sandviken, Sweden. Sandvik also announced the appointment of DAVID P. CAMERON of Boston chapter as manager of sales for the company's Coromant line of tungsten tools. Cameron has been associated with the tungsten carbide cutting tool field since 1941.

George Sharp, Inc., is the name of the new company organized as a machinery and tool distributorship by GEORGE SHARP, Northern New Jersey, formerly general sales manager of Wadell Equipment Co., Inc. . . . HARTWELL G. HOWE, Worcester, who has been assistant sales manager for The Heald Machine Co. since 1955, has been made sales manager. . . . ALBERT R. FAIRCHILD of Piedmont chapter, vice chairman of the ASTE National Professional Development Committee, has been promoted to senior staff engineer by Western Electric Co.



Bonus Issue Due in June!

A BAKER'S DOZEN is a bargain. This will become readily apparent to 40,000 readers of THE TOOL ENGINEER next month when they receive a 13th issue of the magazine that is already the biggest bargain in the metalworking field.

THE TOOL ENGINEER Suppliers Directory Issue—600 pages of reference, editorial and advertising material fashioned to fit the product information needs of the men who create and improve production methods—will be published June 15 as an added service for the ASTE membership. It will be included in the regular subscription price.

Supplementing the monthly issues of THE TOOL ENGINEER much as a concordance supplements the Bible, the Suppliers Directory will combine the indispensability of a national directory with the close-to-home applicability of the yellow pages in your phone book. In short, it will be a national directory of local sources.

Some 18,000 individual manufacturer's agents, distributors or sales offices will be listed in time-saving geographic order in the special distributor section. No longer will the tool engineer have to say, "They have the sizes I need, but I don't know of a service outlet in our area."

In addition, the Suppliers Directory will contain a thousand product listings, all pertaining to the function of metalworking (more than 12,000 company names will appear in this section); 2500 manufacturers, with 45,000 distributor listings beneath the manufacturers' names (a single distributor can represent many companies); and 50-plus pages of high-application-value editorial material never before published, including a how-to-use feature on a numerical coding system.

The desirability of such a directory, giving on-the-job facts about manufacturers and their products as well as immediate sources of those products, was confirmed by many months of study. A qualitative survey was conducted by an independent consultant firm and sponsored by the ASTE. Engineers and management men, production and machine design department heads, men with specification and purchasing responsibilities—men of many titles who make up the influential fraternity known as tool engineers—were sounded out on their product information problems during this survey. Results of these interviews were correlated with ideas from special brain-storming sessions at ASTE chapters across the country and channeled into a 160-page report on the production information needs of tool engineers. The forthcoming Suppliers Directory is the answer to those needs.

George Hargreaves, directory editor, said that advertiser acceptance and user anticipation of the 13th issue has been far beyond expectations.

The Suppliers Directory will be specially bound to lie flat and to withstand year-long use.

New Handbook Out in Fall

A COMPLETELY revised *Tool Engineers Handbook* will be published early in the fall. It will be bigger and even better than the renowned first edition, which was originally published in 1949 and has since gone through eight printings.

There's still a limited supply of first edition *Handbooks*, and they're available—as long as they last—from the Publications Sales Department, ASTE Headquarters, 10700 Puritan Ave., Detroit 38, Mich. Members who need a *Handbook* now, or who will need one in the next few months, are urged to get their orders in before the supply is exhausted.

chapter news and views

Newscaster Points Up Slave Labor Role in Soviet Challenge

SAN FERNANDO VALLEY—In a challenging speech before the chapter on Mar. 4, Clete Roberts, radio and TV newscaster, revealed what lies behind the Communistic threat to the free world. Roberts titled his talk "1959—A Climate for War and Peace."

The USSR today, he said, considers its educational program its religion. It is the dedication to this program that gives the Russians the confidence they display so conspicuously to the Western World. It is this same religion that is developing Sputniks and other war implements. And, finally, it is this religion that gives Khrushchev the confidence to challenge the Allies to an economic war as well as a shooting one.

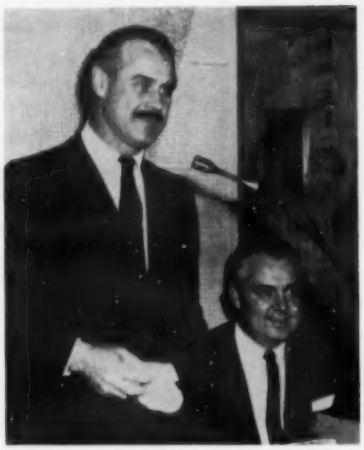
After speaking so highly of Russian technology Roberts restored the faith of those present in the American missile program by describing his visit to Cape Canaveral.

Warning against too much optimism, however, the speaker cautioned the members and wives that missiles are only half of the challenge extended to the United States. The other half is an economic one. The Soviet Union, he said, is still using slave labor to compete with the free world. Russia, maintaining a government which owns everything, is willing to and does sell its goods on the open world market at a loss, just to gain political advantage. From this we can conclude that it is not a shooting war the Russians are interested in primarily, Roberts said; they feel they can conquer the world simply by winning the economic one.

Summing up, Roberts stated that it was up to the American people to accept the Russian challenge. And this is where the tool engineer comes in. By conceiving newer, better and faster means of putting goods on the market, the tool engineer not only can compete with, but may be able to help stamp out slave labor in the country which utilizes it.

Also taking place at this meeting was the installation of newly elected officers. Taking the oath of office were: Tom Tomlinson, chairman; Robert Edgcomb, first vice chairman; Sam Longo, second vice chairman; Robert Fried, third vice chairman; Art Hunter, secretary; and Harold Guellow, treasurer.

—Art Hunter



Listening to a question from the audience is guest speaker Clete Roberts. Seated next to him is ASTE Vice President Wayne Ewing, also a San Fernando guest.

PITTSBURGH—R. J. Zale receives the chairman's pin from outgoing Chapter Chairman W. B. Kiefer at the March meeting, at which new chapter officers were installed. *—Ralph M. Keenan*

COLUMBUS—Archer B. Jones (right), chapter chairman, congratulates Frank Galbraith, Jr., winner of one of ten ASTE International Scholarships. Galbraith will use the award to do graduate work at Ohio State University.

—G. E. Rauberts

Top ASTE Leaders, Past and Present, Gather at Dayton

DAYTON—A meeting attended by several ASTE luminaries was also highlighted by an Award of Merit presentation and installation of newly elected chapter officers. The meeting, Dayton chapter's March gathering, bore the theme of "Industry and ASTE, Partners in Progress," and listed among those present National President George Goodwin, past President Howard McMillen and Vice President Dale Long.

Long, in keeping with the theme of the meeting, addressed the group on the competition existing in industry today. He stressed that because of this competition constant improvements must be made in products and constant alertness must be maintained by tool engineers as to new technical data. Only in this way can companies remain competitive. Long also recommended active membership in ASTE as a good means of keeping up to date with new developments in industry.

The new Dayton chapter officers accepted their oath of office from President Goodwin. Installed were Andrew C. Bailey, chairman; Herbert Leach, first vice chairman; Vincent Rhoades, treasurer; Noel Atherton, secretary; and William Whyte, second vice chairman.

Earl V. Johnson, president of Dayton Carbide Tool Co., was presented with the Award of Merit plaque he won as a result of his service to his chapter, on national committees, and to his community. *—Ralph Frederick*

Progress in Tolerances Pinpointed in Talk

SANTA ANA VALLEY—Whereas in 1918 ± 0.0003 was considered extremely close in equipment for grinding and measuring, today's demands have tightened this to ± 0.00001. So stated James Meehan, assistant to general sales manager, machine tool division of Brown & Sharpe Mfg. Co., at the monthly meeting of the Santa Ana chapter.

In a talk entitled "Grinding to Millionths," Meehan pointed out that you can machine only as close as you can measure, and with progress such as we experience today in the missile and rocket field, tolerances are becoming tighter and tighter. The precision manufacturing processes existing presently necessitate a higher degree of accuracy in centers, coolant controls, size and type of grinding wheels, and mounting of machines than ever before.

—Robert C. Gordon

MELBOURNE—Chairman R. Chaney (left) accepts framed charter from Frank Ritchie, past chairman of Windsor chapter and member of the national public relations committee. Ritchie officiated at the recent ceremonies launching the second ASTE chapter in Australia.

Advantages of Magnesium Discussed at Wichita

WICHITA—The advantages of magnesium for tooling applications — its light weight, dimensional stability, close flatness tolerance, relatively high strength, high rigidity per weight, ease of cutting and welding, adaptability for welding fixtures, and nonsticky splatter —all these were pointed out in a film presentation before the Wichita chapter at its March 11 meeting.

Harry M. May, manager, magnesium sales, Hubbell Metals Inc., and John Saley, Wichita representative for Dow Chemical Co., spoke to the 41 members and guests on the operation of the Dow Midland plant and on the typical applications of magnesium in tooling fixtures. They also tried to dispel the stigma that so often accompanies the mention of fire and its connection with the fabrication of magnesium.

At this same meeting new officers were installed. They were: William Unruh, chairman; David Duffy, first vice chairman; William Chambers, second vice chairman; Glen Dolton, third vice chairman; Frank Dickerson, secretary; and Doyt Greer, treasurer.

Mention was also made of the "Grooming Production for This Space Age" institute to be held for the first time at the University of Wichita under the cosponsorship of the ASTE Wichita chapter and the U. of W. student chapter. —*Frank Dickerson*

Man-Made Diamonds Studied at Ann Arbor

ANN ARBOR AREA—The speakers at the monthly technical meeting were J. D. Kennedy, manager of the diamond section, General Electric Co.; and John W. Ripple and John A. Mueller, both of The Carborundum Co.

Kennedy described the products of "the world's first diamond factory" as being less strong and rougher textured than the real thing. Mueller, manager of the Carborundum's grinding laboratory, explained the exacting tests made to evaluate the first "manufactured diamond" grinding wheels, which showed they were up to 64 percent more efficient in grinding carbides than natural diamond wheels.

Ripple, who had charge of the field development work on the new wheels, said manufactured diamonds are most effectively applied when heavy infeeds and dry grinding are avoided.

This exposition on the characteristics and applications of man-made diamonds was held in the Ann Arbor High School. —*Frederick L. Fitts*

chapter news

Ann Arbor Area 107
Atlanta 111
California Polytech 109, 111
Cincinnati 110
Columbus 106
Dayton 106
Detroit 110
Erie 112
Evansville 110
Hartford 110
Houston 111
Indianapolis 108
Keystone 113
Lansing 109
Lima 108
Melbourne 107
Monadnock 111, 112
New Haven 113
Northern Massachusetts 111
Northern Pennsylvania 108
North Texas 111
Northwestern Pennsylvania 110
Ogden 109
Peoria 110
Pittsburgh 106, 109
Portland 108
Saginaw Valley 110
San Fernando Valley 106
San Francisco 109
San Gabriel Valley 111
Santa Ana Valley 106
Southeast Florida 110
St. Louis 108
Western Reserve 112
Wichita 107
Williamsport 112
Worcester 113

World Catching Up With U. S. Technology, Industrialist Warns

ST. LOUIS—With prosperity and unemployment existing simultaneously, the United States is now experiencing one of the most unusual economic periods. In a talk entitled "Business Trends," W. R. Persons, president of Emerson Electric Mfg. Co., St. Louis, explained this phenomenon. Addressing the St. Louis chapter at its Executive Night meeting, Persons said that the reason is a revolution in products, markets and distribution, and a world which is catching up with U. S. technology.

If we are to maintain prosperity in the next decade we will have to meet this challenge with increased efficiency and productivity, Persons declared. Products and production methods are changing rapidly, and companies which do not keep pace with the times must reduce their labor force because their products cannot compete.

Persons said we are on the threshold of a great change, one as important as the beginning of the Industrial Revolution. Four great trends have resulted from this change. The first of these is the increase in research and development. Second is the revolution in distribution. The rapid growth of shopping centers and the discount house type of merchandising exemplify the search for cheaper methods of distribution. Basic research in why people buy and what influences their selection is considered in designing a product and in planning the most effective method of promoting its sales. Automation and inflation comprise the third and fourth trends.

It is Persons' theory that whole companies and even whole communities will cease to exist if they cannot maintain competitive production positions. Inflation and unemployment can be checked only when wages are as high and hours of work as low as competition and productivity will allow.

—Lyle R. Perry

Lima

"The Present and Potential Uses of Cemented Oxide Tools" was the subject presented at the Feb. 19 dinner meeting by Benjamin E. Storrs, cutting tool specialist of the Metallurgical Products Department of General Electric. The speaker compared the temperature and hardness of presently used cutting tools and limitations of oxide tools, supplementing his talk with a film and slides. Election of officers followed.

Pictured at St. Louis meeting are Chapter 17's new officers and David Schrom, ASTE vice president. From left are William Scheublein, first vice chairman; Orvell Essman, second vice chairman; Kenneth Ritter, chairman; Schrom; Eugene Z. Frerichs, secretary; Louis Malpocker, treasurer; and Charles Hawkins, third vice chairman.

17 Past Chairmen Attend Indianapolis Meeting

INDIANAPOLIS—A program on Die-Draulic Grip was presented at the Indianapolis chapter meeting for March. C. A. Barrett, president of Die-Draulic Grip Co., declared that this hydraulic system features controlled pad pressure and constant pressure during strokes of the press which are impossible with other cushioning devices. By exerting full pressure from the start of the stroke, it turns out better stampings and fewer rejects, he said.

Barrett showed one instance where an automobile manufacturing firm used one manifold and ten cylinders with punches to punch holes in the side of a fender. By performing it with the new method they saved by not having the need for a large piercing die. When there is a model change they simply rearrange the cylinders and they have a new die. With the old method, however, they would have had to scrap the old die and build a new one.

This same meeting also saw the gathering of 17 of the past 19 chairmen of Chapter #37.

—Robert R. Huser

High Schools Receive Chapter Donations

NORTHERN PENNSYLVANIA—Under this chapter's educational program, needed equipment and tools are donated annually to local high schools in Elk and Cameron counties. This year three schools benefited from the plan. The gifts, which were accepted by representatives of the individual schools, had a cash value of over $200.

The schools represented and their gifts were: Central High, which received a set of oxygen and acetylene regulators for welding; Johnsonburg Area Joint School, a *Tool Engineers Handbook* and a subscription to THE TOOL ENGINEER magazine; and Cameron County High, a Black & Decker ½-inch electric drill.

The chapter hopes such donations will create student interest in the tool engineering profession.

Chapter officers for 1959-60 were installed following the presentations to the schools. Dale Long, ASTE vice president, swore the men in and delivered a short talk before the 51 present at the meeting.

—W. S. Spehalski

PORTLAND—Pictured at the dinner meeting of the Portland and University of Oregon chapters are: Prof. Milton Sheely, student chapter adviser; Donald Partridge, student chapter first vice chairman; Glen Kach, new Portland chapter chairman; John McKay, student chapter chairman; and Bill Simpson, outgoing Portland chapter chairman. The beards are part of Oregon's centennial year celebration.

—John Couts

Utah State, Purdue Plan Summer Seminars

In order that engineers who have been away from the classroom for a while and, too, interested students, may keep abreast with changing materials, technological advances and up-to-date equipment and methods, two universities have scheduled summer school sessions in various phases of tool engineering. Utah State University and Purdue University will hold the seminars on June 8 to 13 and June 13 to August 1, respectively.

Leading the Utah seminar with discussions of forming, ceramics, gaging and optics, machining, brazing and welding, will be Cal Jones, chief tool design supervisor; C. C. Lacey, project chief, manufacturing research; and C. M. Burns, project chief, manufacturing engineering; all of Boeing Airplane Co.; and L. C. Pigage, management consultant, University of Illinois.

The Purdue session, a course outlined to acquaint students and industrial personnel with the use, limitations and tooling of general purpose and production machine tools, will provide good background for industrial positions related to production and tooling. Specific subjects to be covered are general-purpose machine tools, production machine tools, inspection and quality control, casting processes and design, welding, and heat treating.

The fee for the Utah seminar is $50 for two courses. Purdue's "Machine Tool Laboratory," sponsored by the Indiana Council of ASTE, will cost $30.

San Francisco Gets Facts on Taps, Tapping

SAN FRANCISCO — The "Facts on Taps and Tapping" were given to 64 chapter members at the monthly meeting. Edward J. Cray, western district manager, Greenfield Tap & Die Corp., outlined the history of the development of screw threads.

In the early days of Rome, he said, screw threads were used on armor. Their use was confined to this right down through to the Revolutionary War. By 1820, however, they were cut on a lathe. Standardization came about in 1860. Taps were used first in 1800 and dies, about 1872.

Cray also pointed out that lubricants, and not coolants, should be used for taps. With proper lubrication and alignment, taps will provide greater service, he said. Taps are held to close tolerances through gaging. Standard taps are used for all metals.

—Chester L. Norton

PITTSBURGH—J. M. Guest, machine shop instructor at Connelley Vocational High School, Pittsburgh, looks on as W. F. Coles, Chapter #8 first vice chairman, presents the monthly "Outstanding Student Award," a Tool Engineers Handbook, to E. Thomas Biss, at the March meeting. *—Ralph M. Keenan*

Lansing

At the technical meeting Mar. 9, C. D. Harrington, administrative engineer for Oldsmobile Div., GMC, spoke on the styling of the new car and showed a slide presentation of steps from the original idea of styling through the introduction of the new model. The 1959-60 officers were installed by former ASTE President Les Bellamy. Glen L. Crippen, public relations chairman and former chairman of the Lansing chapter, was awarded a merit award pin for the second time in five years for his outstanding work within the chapter.

California State Polytech

At the Mar. 4 technical meeting on the college campus, 40 members and guests heard R. C. Van Kirk, sales engineer at Minnesota Mining & Mfg. Co., speak on structural adhesives. Some of the advantages he listed in using adhesives were excellent fatigue resistance, even stress distribution, continuous contact of the mating parts, and the fact that there are no external projections to interfere with the integrity of surfaces. Kirk also spoke on adhesive applications in aircraft, automotive and constructive industries.

OGDEN—Receiving their affiliate membership plaques from Chairman pro tem S. H. Parsons (second from left) are (left to right) Claude Bagerley, Ogden division, Tool Research Co.; J. Nemec, Ogden division, Commercial Consultants Corp.; and R. Meeker, Odgen division, Omega Design Associates. *—S. H. Parsons*

SOUTHEAST FLORIDA—Taking the oath of office from Edgar Doogan, past national director and charter chairman of St. Louis chapter, are (left to right) Charles W. Stephenson, secretary; Paul N. Krebs, second vice chairman; Cedric W. Scofield, first vice chairman; and Thomas L. Williams, chairman.

EVANSVILLE—Appearing after their installation at the March meeting are new officers (left to right) James Dawson, secretary; John Schaus, first vice chairman; Charles Hinman, chairman; Walter Lockmueller, second vice chairman; and Robert Parker, treasurer. *—Earl R. Crowe*

PEORIA—Congratulating the new officers after their installation is guest speaker Gordon Swardenski, assistant plant manager, Caterpillar Tractor Co. The officers are (left to right) Olin C. Simpson, treasurer; Howard R. Poland, secretary; Walter Bristow, second vice chairman; Charles C. Tobin, first vice chairman; and Harold H. Austin, chairman. *—V. D. Ekiss*

HARTFORD—A group of experts conducts one of the panel discussions at the Hartford chapter's "Analysis of Metal-Cutting Methods" seminar held March 11-12. The two-day session was designed as an educational opportunity specifically for professional men with industrial production responsibilities. *—Paul Pick*

Saginaw Valley

One hundred forty-eight members and guests were present at the Feb. 12 meeting where a panel discussion was held on stamping die design, with the relative merits of design by theory or by experience being the topic of the evening. Various items were reviewed by the panel members, such as die clearances, spring specifications, screw and dowel size and location and economic class of die construction. On the panel were Cliff Johnson, director of production engineering of AC Spark Plug; Andy Simpson, who holds the same title with Ternstedt Div., Flint; Ray Wendt, superintendent master mechanic, Chevrolet, Flint and Don Eary, supervisor, die design, General Motors Institute.

NW Pennsylvania

New officers were elected at the dinner meeting Feb. 5. Following the election, Harry Conn, chief engineer of Scully-Jones & Co., spoke on "Economics of Tooling and Manufacturing," emphasizing many points of tooling cost control, which could be studied and applied by all engineers.

DETROIT—Receiving a token of the chapter's appreciation after giving his talk on "Development of Effective Product Analysis Techniques," C. Farnsworth (right), manager, design analysis control department, Chrysler Corp., shakes hands with Treasurer Edward Till.

Cincinnati

Jan. 13 was the date of the third annual education program, combined with Father and Son night, when 100 members and guests were welcomed at the Cincinnati Milling Machine Co. for a tour of the metalworking laboratory. Talks were given by three men of the Cincinnati company—P. Crane gave a welcoming address and showed a film "Research at the Mill"; E. J. Krabacher spoke on "Instruments of Metal-cutting Research"; and W. Pentland talked on "Measure of Forces and Temperature of Machining".

Member with Drive

The most faithful attendance at meetings of Houston chapter has been registered by the member who has to come the farthest. Guy Croom, general superintendent of the Lufkin Foundry and Machinery Co., has made the 240-mile round trip—a far piece, even for Texans—from Lufkin, for as many years as most members can recall.

Croom's regular overnight trips to meetings are a spectacular contribution to the chapter's over-all record of 29.4 percent attendance.

NORTH TEXAS—Newly elected officers for 1959-60 are (left to right) Ben C. Harris, chairman; Hal R. Montgomery, first vice chairman; Ernest R. Adams, second vice chairman; Reid R. Jamison, third vice chairman; and Paul R. Orbison, treasurer. Absent is Al Hall, secretary. *—W. P. Engelfried*

SAN GABRIEL VALLEY—The new officers installed at the March meeting were (clockwise) Bernard K. Allen, third vice chairman; Jack D. Bailey, first vice chairman; Russell J. Stainton, chairman; William Martens, treasurer; and Henry K. Schierhold, second vice chairman. Not appearing is Orlando F. DeCastro, secretary.

Northern Massachusetts

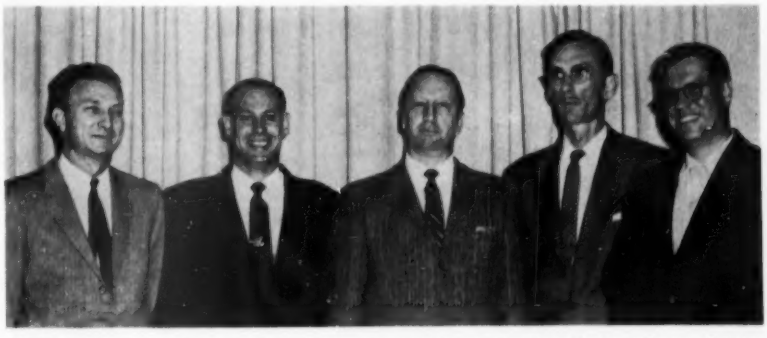
"Cerrotechnics" was the subject of a talk presented to 65 chapter members and guests at the Feb. 17 meeting, by Robert S. Darnell, assistant manager, Alloy Dept., Cerro de Pasco Corp. Darnell, who has devoted many years to research in low-temperature melting metallurgy, enlarged upon the remarkable properties and limitless applications of bismuth alloys. When the properties of bismuth were defined in multiple combinations involving varying proportions of lead, tin, cadmium, indium and other metals, he said, it brought about many new applications in countless manufacturing plants and die shops.

Monadnock

Following the technical meeting of Feb. 19, members were taken on a tour of the Princess Shoe Co. by Mario Farina, son of the founder. The tour, while not directly connected with the machine tool industry, was most informative and interesting, the members finding that the manufacturing processes paralleled methods and procedures used in the metals trade.

California Polytechnic

Paul B. Slater and Cliff Commeford, owner and sales manager of Paul B. Slater Co., were the speakers at the Feb. 11 technical meeting. They discussed the design and applications of tooling components such as locating devices, work supports and clamps. Since these components are available to industry, they can in many cases create substantial savings in time and money to the manufacturer. Commeford presented some additional information on what some prospective employers expect of tool engineers. This information was obtained from interviews in the course of his work as sales manager.



ATLANTA—Following a meal and a guest speaker was the installation of new chapter officers: (left to right) Paul Kight, treasurer; Ray Culver, first vice chairman; Charles Bolden, chairman; William Matthews, secretary; and George Carson, second vice chairman. *—L. C. Volberding*

Pictured after their installation at March meeting in Erie were (left to right) Thomas G. Brown, first vice chairman; James O. Starn, second vice chairman; Victor Kaliszak, secretary; Richard A. Banaszek, chairman; and Erwin W. Finke, treasurer.

MONADNOCK—Seated around Chapter #124's symbolic bell and gavel are the new officers (left to right) Walter W. Southmayd, second vice chairman; Walter Szacik, first vice chairman; Robert O. Burr, chairman; David A. Piper, treasurer; and George Traak, secretary. *—Paul E. Tilton*

Appearing after their installation at the March meeting are the new officers of the Williamsport chapter. They are (left to right) Alton L. Currin, treasurer; George H. Edwards, secretary; George DeLong, second vice chairman; Robert Foucart, first vice chairman; Samuel C. Fry, chairman; and, pinning the chairman's pin on Fry, Prof. Arthur F. Gould.

Erie Members Hear Speech on Abrasives

ERIE—James Kraeger, sales manager at Engelberg, Inc., did more than "Scratch the Surface" in his talk of the same name at the Erie chapter's March meeting. Among other things, he brought out that an amazing amount of metal can be removed by abrasive belts. Not with just any abrasive belt, but with the new type which utilizes an electrostatic method for fastening the abrasive material to the belt.

The members also took advantage of the meeting to install their new officers for 1959, and give Harold W. Hagle an Award of Merit for his achievements within the chapter and on a national level. *—Andrew Plaza*

Western Reserve

R. S. Darnell, assistant manager of Alloy Dept., Cerro de Pasco Sales Corp., spoke to the members on "Bismuth Alloys" at the Feb. 25 meeting. An interesting point was the fact that molten metals of this type expand upon hardening rather than shrink, which feature lends itself to some useful applications in the tooling field. Many members who are associated with short-run tooling were interested in the fact that such tools are easily used and reclaimable.

Teaching and Learning Simultaneous Process

WILLIAMSPORT—Can a student get too much teaching and not enough learning? Arthur F. Gould, head of industrial engineering at Lehigh University and chairman of the National Education Committee, seems to think so. In his talk at the Williamsport chapter's Education Night meeting, Gould stressed that with too much emphasis placed on teaching and not enough on learning the student has a tendency to become lazy, sit back, and say, "Teach me."

Gould felt that the two should be carried on simultaneously. The student, whether he be in engineering or any other field, must be continually learning, for what is new today may be obsolete tomorrow. We cannot stand still, he said.

Other events of the evening were the presentation of the chapter's Annual Tool Trades awards to the winners, and numerous technical volumes to the James V. Brown Library and the Williamsport Technical Institute. The installation of new chapter officers also took place. *—William A. Paul*

Shell Molding Process Discussed at Keystone

KEYSTONE—The techniques of shell molding, its advantages, disadvantages and applications were embodied in a speech entitled "The Shell Process" given at the Keystone chapter's technical meeting. Malcolm Petrie, sales engineer supervisor at Shell Process Inc., West Springs, Mass., discussed the cost reduction resulting from the use of shell as opposed to green sand molding.

Numerous foundries have discovered applications of the shell molding process to core making has eliminated drying and baking cycles usually required with green sand cores. Cores produced from resin precoated sand are cured in the mold with automatic machinery and oven cycles. However, Petrie stated, for medium-size job lots, where the cost of shell mold patterns could not be justified, a combination of shell process cores and green sand molding has proven economical.

The annual election of officers was held prior to the technical session, with Chapter Chairman Leroy Janson presiding. —*Frank Forquer*

New Haven

A round 100 members and guests were in attendance at the Feb. 12 meeting where they heard Don S. Carr, technical field engineer for The Fellows Gear Shaper Co., talk on the technical aspect of the standardization of gears, gear specifications and the growing need for greater accuracy in gearing. He gave the solution for some of the field problems encountered and followed his talk with a movie, "Gear Manufacturing Equipment."

Positions Available

ENGINEERING WRITER—Man with a knowledge of manufacturing tools and processes to write and edit technical articles. Should have M.E. or I.E. degree or equivalent. Age 25-45. Starting salary $7500 up according to experience and qualifications. Send with first letter complete resume including statement of kind and scope of technical reports, brochures, articles, etc. written. Location in Midwest. Address replies to Box 143, The Tool Engineer, 10700 Puritan, Detroit 38, Mich.

SALES ENGINEER—Job shop in Los Angeles area needs man capable of selling Tool Designing and Engineering Services. Submit fully detailed resume with first letter. Write to: Box 144, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Pictured at the Worcester ASTE-ASM meeting are (left to right) Arthur Lawler, ASTE second vice chairman; E. Daliff of B. Jahn Mfg. Co.; E. E. Hall and Chet Hamilton, speakers.

135 ASTE-ASM Members Meet at Worcester

WORCESTER — A joint meeting of ASTE and ASM of Worcester on "Die Design, Steel Selection and Heat Treatment" featured an across-the-table discussion of some specific dies and selection of steel required for these dies.

"Dies can be simple or complex," stated Chet Hamilton, sales manager at B. Jahn Mfg. Co. and main speaker of the evening. "Closer cooperation between the designer of the specific part and the diemaker can result in simplification of the die. The die designer must visualize the first station and the blank's shape as it would progress through the press. He then should complete the progressive die with as few efficient stations as possible."

The depth of a draw in a progressive die must be limited, Hamilton continued. A deep draw will slow down the press to a point where a single stroke press would do the job. In some dies replacing and interchanging should be possible if a long run has occurred with little or no changes.

E. E. Hall, manager of technical service, Universal-Cyclops Steel Corp., spoke on steel selection and heat treating. He said selecting one type of steel and saying it is an all-round steel for any die is a mistake. The selection of the right steel to fit the job is of great importance to the life of the die, the precision held on the job and the over-all cost of the die.

The job specifications will call for the type of steel to be used. If the gage of the steel to be used for a part is below 40 thousandths, one grade can be used. As the gage becomes thicker a slightly harder and tougher steel should be used until the air-hardened tool steel level is reached.

To select the proper steel for the die, Hall declared, the following factors should be considered: job material, method of forming, number of die stations or press strokes, heat treatment properties of the die steel required, possible life of die compared to pieces to be made, and cost of steel.

There is also no one steel that has ideal properties, Hall said, that is, one that wears best in heat treating, resists chipping, etc. To arrive at one property, another must be sacrificed. To prevent chipping a die steel is softened somewhat, but this also adds to the wear. However, the number of parts will determine the properties most desired in the steel and selection is made by looking over the results possible when the steel is heat-treated.

In conclusion, Hall stated, care should be taken in all heat treatings to attain a good surface condition. Atmosphere-controlled furnaces which prevent oxidizing are preferred. This will eliminate further machining of the die.

There were approximately 135 members of the two societies present at this meeting, and all participated in the questioning period. They also viewed a film, "Manufacture of Tool and Dies," showing the development of the tool and diemaker from apprenticeship to graduation. —*Robert A. Cusson*

SPECIAL EVENTS

ASTE Semiannual Meeting	Oct. 8-10	The Chase-Park Plaza Hotels St. Louis, Mo.
Production Institute	May 4-5	University of Wichita Wichita, Kan.
"Optical Tooling and Gaging": ASTE Seminar	May 6	The Chase-Park Plaza Hotels St. Louis, Mo.
Central New England Council On-Campus Conference	May 9	Massachusetts Institute of Technology, Cambridge, Mass.
11th Annual Connecticut Day	May 14	Bridgeport, Conn.

V-R TANTUNG®

Designed for cutting speeds between high speed steel and carbides

SOLID TOOL BITS
•
CUT-OFF BLADES
•
CAST-TO-FORM
•
TIPPED TOOLS

V-R TANTUNG bridges the gap between maximum cutting speeds of high speed steel and practical minimum speeds of cemented carbides . . . and it's easy to grind with aluminum oxide wheels.

High red-hardness; high transverse rupture strength; low coefficient of friction and high shock resistance are a few of the characteristics which make TANTUNG cast alloy the ideal tool material for intermediate cutting speeds.

Ask your V-R representative to show you how TANTUNG can cut costs on many of your machining operations. He will also be glad to give you full information on V-R Ceramic and Carbide cutting tools for your higher speed jobs.

"Where and How to use TANTUNG" — Facts about all types of TANTUNG tools . . . how to grind and braze . . . examples of production cost-savings, etc. Ask for Booklet No. 573.

V-R Vascoloy-Ramet corporation

PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

T-706

858 Market Street • Waukegan, Illinois

Progress in Production

INTEGRATED PRODUCTION BRINGS CASTING ECONOMY

With an eye to providing an integrated facility to budget-conscious production men, Lobeck Casting Processes Inc. developed a machine which allows aluminum strip consumers to perform their own melting, casting and rolling in one operation. Based on a Pechiney-designed unit presently in production in a French aluminum plant, the machine does continuous casting of aluminum and aluminum alloy strip.

The casting line is fed by a combination of melting and holding furnaces charged with scrap and ingot metal. A launderer connects the holding furnace with the casting machine, and the metal flow rate is accurately controlled. Prime component of the machine is a 5-foot diameter wheel with a trough shaped groove along its circumference. Depth and width of the groove determine the size of the "slab" to be cast. An endless steel belt running along part of the casting wheel circumference and over guide sheaves, closes the groove for casting purposes. Water cooling of the casting wheel and belt assure solidification of the liquid metal into a continuous slab during its travel along the wheel circumference. Fast chilling action provides a particularly sound metallurgical structure.

Upon solidification, the slab leaves the wheel and feeds continuously into an adjacent 2-high hot rolling mill where it is subjected to a heavy bite. From here the hot strip passes through a water cooling unit before entering the 2-high cold rolling mill for further heavy reduction. Thickness of the cold finished strip is continuously measured by a flying mike, while a flying shear cuts the strip whenever a full coil has been obtained.

Double coilers with collapsible drums assure continuous operation of the line; one coiler winds strip while the other is being unloaded. The entire processing line is electronically synchronized and centrally controlled from a console. Running the overall machine requires only three men.

In one installation, ⅛ x 8-inch type 3003 aluminum alloy strip is produced in 16-inch ID x 50-inch OD x 1300-lb coils at a continuous rate of about 4 tons per hour. For such applications as impact extrusions, coilers are not required and the cold rolled stock is fed directly into a blanking press producing slugs. To obtain thinner gages of strip, the ⅛-inch stock is processed further in a tandem cold reduction mill capable of output speeds up to 1000 fpm for faster production.

'PERMANENTLY MODERN' EQUIPMENT THROUGH USE OF MODULAR CONSTRUCTION

Obsolescence is the problem that Cleveland Hobbing & Machine Co. is hoping to defeat with its new line of lathes, automatics and chucking machines. The manufacturer, a division of Textron Inc., has utilized modular construction to permit a user to start only with essential equipment and add components or change them as needed. With the use of a rigid base machine and a wide selection of heavy duty components, almost any production type turning machine is created. The parts all fit universally, thus machines can be changed over or rebuilt with new components with a minimum of time and effort.

Six precision headstocks that offer turning speeds up to 5000 rpm, are that heart of the "modular machines", and four rigid beds of varying length universally unite with headstocks and other components to make the various types machines. The beds are available in a range of sizes from a 30-inch pedestal type bed to a 140-inch bed.

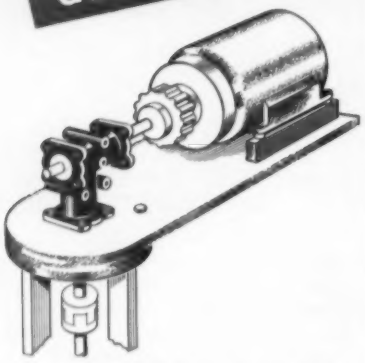
CONSOLIDATED OPERATIONS CUT PRODUCTION TIME

To simplify its operation and decrease both unit and overall time in production, Hobart Brothers Co. followed the suggestions it has been making to other companies. Operations from two different departments were consolidated into one automatic station, and manual stick electrode welding was changed to semiautomatic CO_2 shielded arc welding. Result was a cut in welding time of transformer core pieces of 62 percent, and a reduction in overall production time of 45 percent.

In making the outside core pieces, welds joining the mounting brackets are made with the fixture in the flat position as shown here. To make other welds on the same job, the fixture is folded, then rotated 180 deg to make the third weld.

Prior to the change, laminations of 26 ga electrical steel were blanked out in the press department and trucked to the core department for manual stick electrode welding. An operator clamped 420 laminations in a jig and manually welded them together with three 7-inch welds. From this jig, the pieces were

ANGLgear® simplifies power package design



Drawing based on photo shows ANGLgear power takeoff on power package for liquid tar pump. ANGLgear's compactness and 4-way mounting simplified design of unit, helped reduce size.

In designing a power package for a portable tar pump used in roofing work, Continental Cleveland Corp., Cleveland, Ohio, needed a simple, compact 90° power takeoff to stand rough service and handle heavy transmission loads.

A Model R-340, 5 hp ANGLgear met these requirements perfectly. Because of its compactness and 4-way mounting feature, it was easily designed into the power train and helped reduce the size of the entire power unit. It also had the necessary stamina to absorb the loads involved in pumping liquid tar to heights up to 90 ft. Completely enclosed, it could not be fouled by the tar.

Perhaps ANGLgear can solve a 90° drive problem for you. Designed for manual or power operation, ANGLgears are available from stock in ⅓, 1, 2¼ and 5 hp ratings, with 2 or 3-way shafting, and 1:1 or 2:1 gearing.

See our literature in Sweet's Product Design File or contact your local distributor.

AIRBORNE®

Engineered Equipment for Aircraft and Industry

AIRBORNE ACCESSORIES CORPORATION

HILLSIDE 5, NEW JERSEY

INDICATE A-5-116

transferred to another jig where two of them were positioned back to back and welded together to form inner core pieces for transformer windings. Mounting brackets for outside core pieces were welded to the pieces in the first jig.

Following the consolidated approach, a single automated station does the job. Electrical sheet steel of 26 ga in 2,240-lb coils is delivered to the station. Coiled steel is placed on an auto centering reel and fed to the automatic press through a continuous straightening machine with mechanical speed variation. To start the blanking press, the operator merely depresses the foot switch and the laminations are forced out a conveyor attached to the bottom of the press. The L-shaped laminations then are placed in a pneumatic fixture which has duplicate sides with a pivot joining them.

The laminations are semiautomatic welded with carbon dioxide as a shielding gas. A reactor in the welding circuit minimizes weld spatter and helps save on amount of welding wire used. Feed speed during the welding is 177 ipm. A welding speed of 14 ipm is attained as compared with 9 ipm with manual stick electrodes. The cleaning operation now is avoided which saves further time. Daily production is 45 complete assemblies per day as compared to 25 per day with the old method.

MOLDING STEEL WITH TNT

An explosive-forming technique utilized for a tricky job at Boeing may offer possibilities for difficult molding work in industry. The illustration shows the method that will be used when producing fuel tanks for the IM-99 Bomarc missile.

First, the tank is welded together from high-strength steel alloy, then heat

treated, and finally placed in a two-piece sizing die and filled with water. A specially mixed TNT-like explosive charge is lowered into the flooded tank and remotely set off by an electric detonator. The blast molds the steel tank to the close tolerance and aerodynamic smoothness required by the engineering design of the missile.

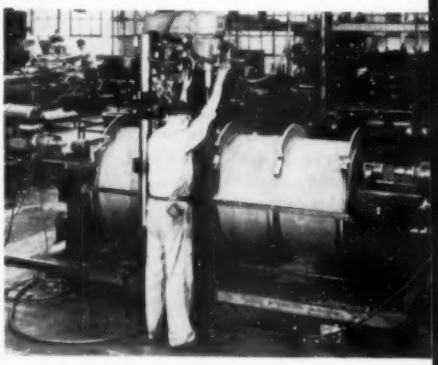
When perfected for production, engineers predict the method will shorten flow time and cut rejections and rework.

CARRIAGE MOUNTED DRILL NETS PRODUCTION ECONOMY

At the Cleveland plant of Harris-Seybold Co., a division of Harris-Intertype Corp., engineers devised an ingenious setup for drilling hard-to-handle workpieces. The specially mounted and adapted Walker-Turner 20-inch drill press has eliminated need for moving a large printing press transfer cylinder to a radial drill. Result: drilling time has been shortened by a third.

The cylinder formerly was carried by crane to the radial drill where vertical holes were drilled and tapped in separate operations. Now the drill press is mounted over the cylinder and is used to drill and tap vertical holes in the same setup in which horizontal holes are bored by two horizontally mounted drill heads at either end.

The drill press is positioned on an elevating slide mounted on a carriage that rides tracks along either side of the platform. This setup permits positioning at any point. A reversing duty electric motor, controlled by a three-position switch and limit switches actuated by spindle movement during tapping. permit both drilling and tapping. A quick change chuck permits shifting from drilling to tapping without repositioning.



TOOLS of today

Numerical Control

Four independent motions of machine tools can be controlled simultaneously by this unit, which is designed for four-axis milling machines. It controls horizontal, vertical, longitudinal and tilt positions. The unit is designed for difficult part shapes, requiring twist type cutting with close tolerances. Input to the control unit is punched tape. The tape reader on the machine control unit permits tape reading of 300 lines per second in the forward direction and 600 lines per second in the reverse direction.

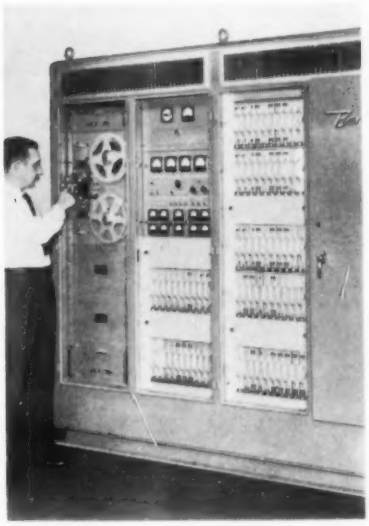
Automatic tape rewind feature frees the operator so he can remove the part as the tape is being rewound. The unit provides high-speed parity checking of a new control tape as it is being mounted on the reader.

Four-decimal display position indicators with continuous readout of position location on all four axes facilitate setup operations, and assist in manual operation of the machine tool during simple machining operations.

Four auxiliary tape control functions also are available with the unit to automatically control such functions as coolant flow, spindle speed, tool changes, table indexing, chip conveyor, etc.

The circuits of the unit are almost exclusively digital in nature. Circuits are mounted in standard plug-in packages and printed circuit wiring is used.

Industrial Controls Section, Bendix Aviation Corp., 21820 Wyoming Ave., Detroit 37, Mich. **T-5-1**



Band Saw Blade Welder

Blades up to ¾ in. widths can be welded on this band saw blade welder.

The machine incorporates a factory-set flash adjustment, jaw clamping adjustment, tension adjustment and blade width indicator.

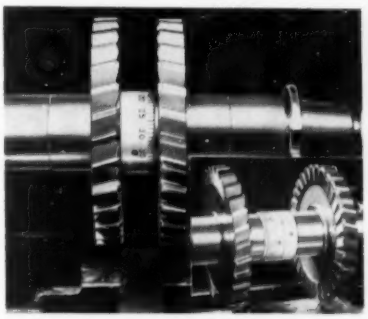
Other features of the welder are a blade shear and a grinding wheel for removing flash. Mounting brackets so the welder can be directly mounted to Delta and Walker-Turner band saws are available.

Rockwell Mfg. Co., Power Tool Div., 454 N. Lexington Ave., Pittsburgh 8, Pa. **T-5-2**

Arbor Spacers

Adjustable micrometer arbor spacers, primarily for use in straddle milling, have 0.001-in. gradations which make shims unnecessary. Other applications for the spacers include raising blocks, fixture spacers, gage sets, and stops for milling machines, lathes, drill presses, turret lathes and die jacks.

Spacers are available in ⅜ to 1½ in. widths, larger sizes up to 5 in. can be made on special order, or special sizes can be made to specifications. Those with widths ⅜ to 1 in. are a non-locking type, widths 1½ in. and up are a locking type.



Narrow sizes have ⅒-in. adjustment, and wider sizes have up to ¼-in. adjustment. One revolution equals ⅒-in. Each spacer has a keyway slot.

Mayer Engineering & Mfg. Co., 815 S. 9th St., Milwaukee 4, Wis. **T-5-3**

Tracer Control For Contour Turning

Conversion of vertical turret lathes for contour turning within extremely close tolerances can be accomplished with the electronic-hydraulic Duplimatic tracer control. High response Pegasus

servo valves are mounted directly to Vickers piston motors. The tight position loop thus provided, together with tachometer feed back directly from the hydraulic motor shaft, permits tolerances of ± 0.005-in. at 25 ipm and ± 0.0005-in. at speeds to 5 ipm, assuming the vertical turret lathe to which the Duplimatic is attached is capable of maintaining such tolerances.

The tracer unit does not interfere with conventional operation of the machine tool. The hydraulic motor drive units disengage with the start and stop button by means of magnetic clutches. Each of the electronic components are of modular construction and can be readily removed for servicing.

Tracer Control Co., 595 E. Ten Mile Rd., Hazel Park, Mich. **T-5-4**

Automatic Screw Machine

The Petermann Swiss automatic screw machine incorporates six transversal tools and turrets with six or four spindles and multiple combinations. All of the six spindles of the turret drum can be either rotating or stationary or arranged in any sequence of rotating and stationary. A rotating spindle can be replaced by a stationary one without

removing or dismantling the attachment. The rotating spindle is equally useful for drilling, tapping or external threading.

The various rotating spindle speeds are obtained through positioning of electrical contacts which operate one of three electromagnetic clutches. For such operations as internal grooving, undercutting, etc., the turret drum can be oscillated. An adjustable device on each spindle permits rapid advance to the work.

Indexing of the turret, controlled by an adjustable trip disk, is performed in less than a second, including rapid advance and return of the spindles.

Distributed by The Arthur Loeffel Co., Inc., Merrick, N. Y. **T-5-5**

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Barrel Plating Equipment

Automatic barrel type processing and plating is possible with motorized barrel and carrier contacts. Designed for use in the Abbey-Matic systems, the electrical contacts for rotating power and processing currents are made and broken by the system to duplicate controls by skilled operators.

A dial-cycle selector on each barrel carrier is first set visually, or by metal dispatch key card, at any one of the several different cycle options provided.

NOW...index tables

FOR MORE ECONOMICAL PRODUCTION ON THESE NEW

HANNIFIN

"FD" PRESSES

Heavy-duty open-gap production presses with Hannifin hydraulic index tables...

Available in all of these sizes:

2, 3, 4, 5 and 6-ton bench models
6, 8, 10, 12 and 15-ton floor models

WITH THESE FEATURES...

Dual Safety Hand Lever Controls
Dual Electric Push-Button Controls
Adjustable Stroke Control
Reverse on Pressure or Distance
Full Automatic Cycling
Hannifin High Speed Hydraulic Index Tables
Reciprocating Hydraulic Slide Feeds

USE THEM FOR...

Assembly Operations
Riveting—Staking
Forming—Stamping
Trimming Die Castings
Trimming Plastics
Molding Semi-Conductors
Preformed—Compacting

Call in your nearby Hannifin man—he's a trained production analyst—to prove how you can do more at lower cost with Hannifin presses. Or, write for our new Bulletin 132. It tells the whole story.

HANNIFIN COMPANY

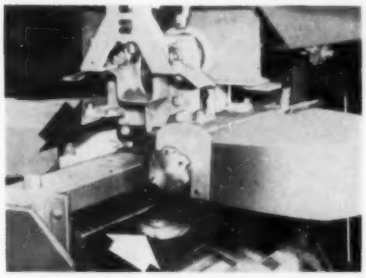
519 South Wolf Road • Des Plaines, Illinois

A DIVISION OF PARKER-HANNIFIN CORPORATION

USE READER SERVICE CARD; INDICATE A-5-118

It then proceeds automatically throughout the system, carrying the loaded barrel, of any make or capacity, in and out of the designated processing stations to the completion of the cycle. Continuous cylinder rotation between stations and through dryers is optional. All other electrically motivated devices required on the carrier are powered similarly. There are no cables.

Processing and plating currents for the barrel are contacted and broken in

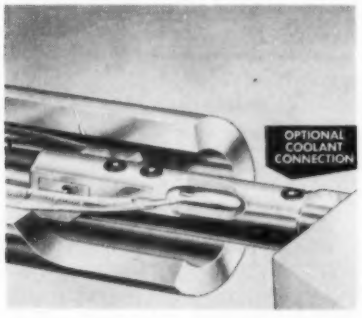


a like manner. Slide contacts located on system framework relay the current through contact shoes on barrel superstructure. Double slides and shoes are used for stronger currents. The barrel's worm gear reducer and motor unit are sealed and mounted under carrier bumper. Sealed worm gear unit, shaft-mounted for direct drive to belts or gears which turn the cylinder, withstands ambient temperatures up to 300 F and is corrosion-resistant for plating room operations.

Abbey Process Automation, Inc., 37-01 48th Ave., Long Island City 1, N.Y. **T-5-6**

Boring Bars

Coolant passages are incorporated into a line of boring bars available in all standard sizes. Coolant is intro-



duced at the cutting edge to reduce chip interference and avoid intermittent heating and cooling. The tool provides a uniformly smooth finish and eases chip removal.

Vee Bee Mfg. Co., 2632 Park St., Muskegon, Mich. **T-5-7**

Clutch-Sheave Package

A combined electric clutch and sheave assembly called Electro-Sheave, can be directly installed on standard NEMA electric motor shafts. Five sizes of standard clutch units rated from 1 to 25 hp, can be applied to new or existing equipment.

The assemblies engage or release at any speed. For inching or jogging, several starts are possible in less than one revolution of the clutch without "normal" wear and tear on motors, controls or machinery. Release is immediate and the load is braked without plugging the motor.

Installation of the unit requires only a key and setscrew plus making electrical connections to the clutch and brushholder from the control panel.

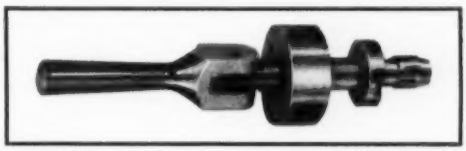
The clutch, ball-bearing sheave, and shaft extension sleeve all fit as a single package onto standard NEMA motor shafts. There is no mechanical connection between motor shaft and sheave, so no torque is transmitted from one to the other. A rheostat in the control panel

LOCATION TOLERANCES OF .0004"

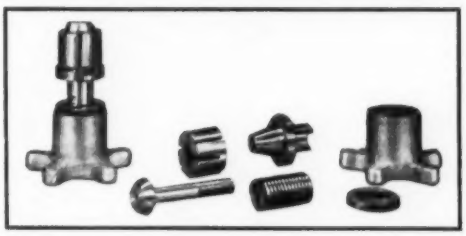
with SPEEDGRIP expanding locators

Gain accuracy—Save time—Avoid errors in loading or unloading work from fixtures! Speedgrip expanding locators are *guaranteed* to repeat fixture location within .0004". Nationally known customers find Speedgrip locators indispensable for holding required tolerances! Assures easier loading and unloading of work.

No. 0 Speedgrip Locator with cam lever actuation. With corresponding bushings, this locator will accommodate bores from 1/2" to 3/4" dia.



No. 2 Locator with hand knob actuation. With expansible bushings, this locator can be used for bores from 1" to 2" dia.



This No. 5 locator can be supplied for either wrench or draw bar actuation. Has precision ground pilot on under side of flange for mounting to fixture. With expansible bushings, this locator can accommodate bores ranging in size from 5" to 11" dia. Locators, with various means of actuation can accommodate bores, ranging from 3/8" to 11".

Some Open Territory • Dealer Inquiries Invited

FREE! Write for Bulletin No. 27 for full description and technical details.

SPEEDGRIP CHUCK
Division of ERNEST, HOLDEMAN & COLLET, INC.
Elkhart, Indiana

USE READER SERVICE CARD; INDICATE A-5-119

M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

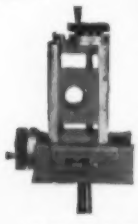
with new Gaertner Coordinate Cathetometers

These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

M1236-46— Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.



M1236-22— Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

Write for Bulletin 188-53 & 194-57

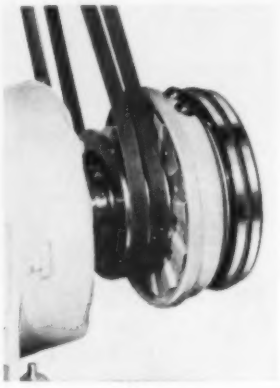
The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.

INDICATE A-5-120-1

can be adjusted to increase torque build-up time, matching the starting torque to load requirements. The electric clutch will not slip at normal operating speeds. However, the rheostat permits exact synchronization of the controlled function with other machinery and reduces shock load on gears, belts and materials in process.

Positive lock-in of the magnet and armature permits controlled no-load starting. Full engagement of the clutch



is possible in milliseconds. Electromagnetic operation permits smooth, precise inching control, utilizing the flywheel effect of the motor rotor to help make several fast starts in only a fraction of a revolution. This method of jogging power transmissions minimizes wear on motors, controls, and machinery.

Warner Electric Brake & Clutch Co., Beloit, Wis. **T-5-8**

Ultrasonic Machine Tool

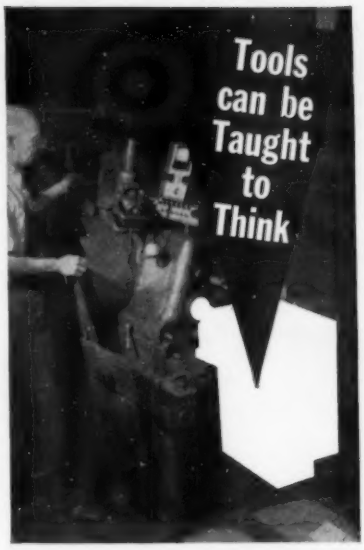
Designed to do the work of eight conventional machines, this Sheffield-Cavitron ultrasonic machine tool provides an efficient method of machining hard and brittle materials such as germanium, silicon, ferrite, glass and quartz in quantity.

Eight horizontal machining stations are arranged in a circle on a waist-high table 4½ ft in diameter.

Only one electronic generator and one transducer are utilized, and the machine requires only one operator.

The machining stations can be operated simultaneously or independently to permit up to eight different precision operations to be conducted on as many workpieces simultaneously, or up to eight individual operations to be performed on the same workpiece by progressing the part through each station.

Combination workpiece and toolholder assembly assures positive workpiece alignment between stations so that parts are precisely located to the cutting tool.



—prove it to yourself

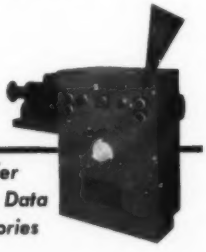
*at Our Expense**

The INCHWORM® motor, replacing the lead screw on centerless grinders, completely eliminates backlash and gives tolerances to ± .000025".

Standard *MICROtrol** 160 gaging and control components can be added to the INCHWORM for fully automatic centerless grinder operation. These reliable, fully proven, closed loop systems have enabled many leading producers of precision parts to achieve previously impossible tolerances at lower production costs.

for:

- ***Trial Offer***
- ***Complete Data***
- ***Case Histories***



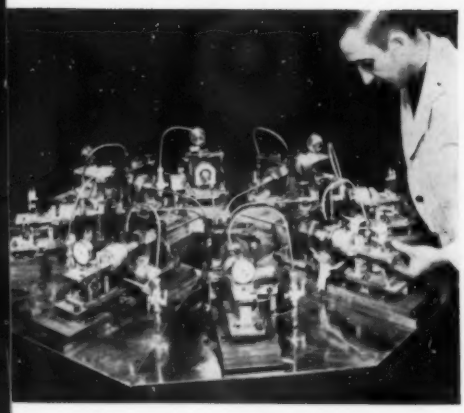
**(Trade Mark)*

Contact your nearest Cutler-Hammer office or write direct to . . .

AIRBORNE INSTRUMENTS LABORATORY

1345 NEW YORK AVENUE
HUNTINGTON STATION, L. I., N. Y.
A DIVISION OF CUTLER-HAMMER, INC

INDICATE A-5-120-2



Each machining station accommodates a cutting tool up to 1.08 in. in diameter, machining workpieces to 0.050 in. depth.

Extended type tooling also can be used to transmit ultrasonic energy over many feet, around corners, and into holes and recesses heretofore beyond the reach of ultrasonic machining.

The Sheffield Corp., Dayton 1, Ohio.
T-5-9

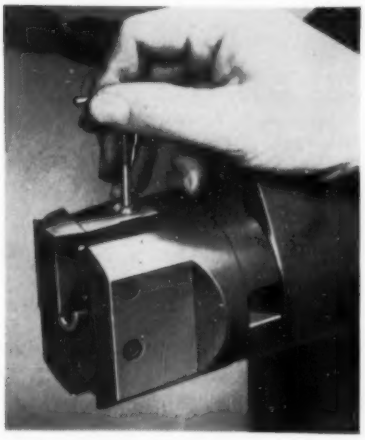
Facing Head

An adjustable-blade facing head for precision plunge facing of wide surfaces requires no special tooling to bore, face or spot-face wide surfaces.

The tool employs a solid one-piece head. Interchangeable high-speed steel or carbide blades may be replaced on the machine.

The dovetail principle of mounting maintains consistently accurate positioning of the blade holder throughout its range of adjustment so that the cutting edge of the blade remains square to the center line at all times. Microface is available in five sizes to machine diameters from 1½ in. to 8½ in.

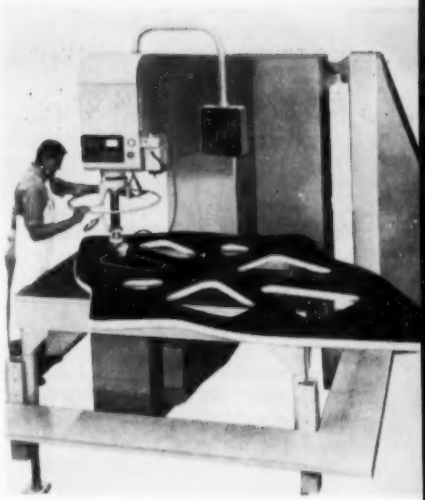
DeVlieg Microbore, Div. of DeVlieg Machine Co., Fair St., Royal Oak, Mich.
T-5-10



Band Machine

An articulated band sawing machine, called the Pan-Arm Model 5 offers unusual capacity to accommodate large or awkward work because of the moving cutting tool. A sweeping head, double hinge, and link construction provide more than 99 sq ft of cutting area and continuous straight-cut length of 17½ ft. The machine shapes and forms large parts from the solid quickly and also provides a fast cut-off method for heavy tubing, plate and structural shapes.

The 4-wheel adjustable speed machine accommodates 21-in. work thickness and has 60-in. throat depth. Upper and lower tool guides that are rotatable so that the saw band may be turned 360 deg. The torque-motor driven steel feed wheel that rests on the



STOP DOWN TIME

Specify Accurate Drill Jig Bushings

ABC Drill Jig Bushings are made of high carbon, chrome bearing steel. Their outstanding resistance to wear means they last longer — are kind to your drills.

ABC bushings are more accurate . . . you are assured of uniformity and dimensional stability. All finished ground Accurate Bushings are held to a concentricity of .0003" T.I.R. at the exit end of the bore.

ABC Drill Jig Bushings, for all their extra fine qualities, cost no more than ordinary bushings.

You can get ABC Bushings in a hurry . . . same day shipments of all ASA Standard sizes and fast, fast service on all special sizes.

ABC

Write for Lift Swing Tooling Suggestions. Bulletin LS-58

ACCURATE BUSHING CO.

ASA Standard Drill Bushings • Precision Parts • Lift-Swing Drilling Fixtures

443 North Ave., Garwood, New Jersey

USE READER SERVICE CARD; INDICATE A-5-121

floor plate is interconnected to the rotatable guides in such a manner that saw band and feed wheel turn in unison. This enables the operator to "steer" the cutting head with a wheel attached to the upper guide or by means of an optional remote control unit. For rapid positioning, an air cylinder retracts the feed wheel so the cutting head can swing freely. Chips are discharged at the back of the cutting head.

Tool speeds range from 25 to 5000 fpm. This permits saw bands from ¼ in. to 1 in. wide to be used for efficient cutting of most materials. Efficient power transmission is obtained throughout the speed range by infinitely adjustable hydraulic motors coupled to three-speed transmissions.

There are two groups of controls: a fixed group on the cutting head for setup, and a movable group for operational control. The latter are in a compact unit, attached to the machine by a patch-cord.

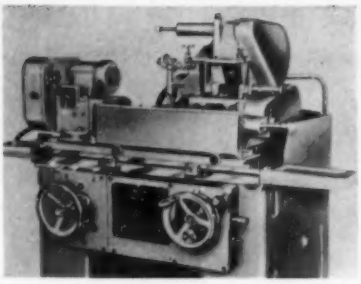
The control unit can be incorporated in an optional closed-circuit television control console, a remote control station, or hung from a pendant. The operator has finger-tip control over both cutting speed and feed.

The DoAll Co., Des Plaines, Ill.

T-5-11

Universal Grinder

Wheelhead of the MSO Model FMES 7 in. x 12 in. universal grinder is mounted on a compound swivel base for grinding steep tapers while a 90 deg



swiveling workhead is provided for face grinding. The machine has live and dead center work spindle, dual speed hand table traverse for shoulder grinding and three-speed power table traverse. Wheel-head infeed is both manual and automatic with fine infeed to 0.00004 in. on work diameter. The table swivels 10 deg in or out.

Distributed by Austin Industrial Corp., P.O. Box 430, White Plains, N. Y.

T-5-12

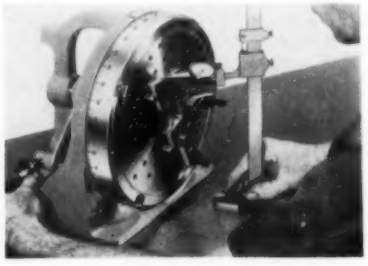
USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Rotary Inspection Fixture

Sine-bar accuracy and vernier speed are combined in the Roto-Mike rotary layout and inspection fixture.

Workpieces mounted on the faceplate can be rotated through any desired series of concentric angle settings by reference to the sine-vernier measuring ring.

A 360-deg vernier scale is engraved on the circumference of the ring. Four



plugs, equally spaced on a 10-in. circle, provide built-in sine bars precisely 90 deg apart.

The ring can be indexed quickly to 0, 90, 180 or 270 deg, using a retractable plunger in the base that engages hardened bushings in the ring. The independent faceplate can be rotated and adjusted separately from the measuring ring and the two then locked together in any relative setting.

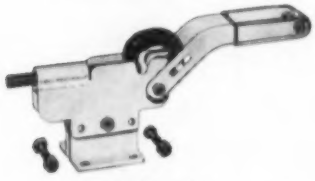
Smooth positioning is gained by use of a differential screw principle in the adjustment mechanism, which is connected to the faceplate spindle in such

INTRODUCING...

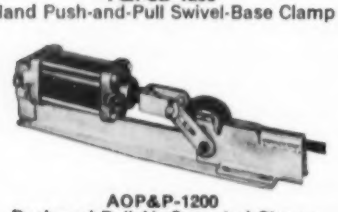
3 NEW

KNU-VISE CLAMPS

P&P-1200
Hand Push-and-Pull Clamp



P&PSB-1200
Hand Push-and-Pull Swivel-Base Clamp



AOP&P-1200
Push-and-Pull Air-Operated Clamp

WRITE TODAY FOR COMPLETE INFORMATION

Push the handle! Pull the handle! It makes no difference—the new Knu-Vise clamps by Lapeer give you uniform clamping of parts. That's real performance! Look at these features—

90° handle motion produces lock of plunger for push or pull without resetting of handle. Handle is reversible. Plunger guided by two widely separated, hardened steel bushings for accuracy in motion and minimum wear. Built-in deflection provides uniformly tight clamping of parts with normal variation in thickness. Swivel base model provides 90° total change in direction of plunger motion. The air (or oil) operated model, AOP&P-1200, produces approximately 4½ times the clamping force with 85 p.s.i. than the cylinder would alone. Failure of air (or oil) pressure does not permit reverse motion of plunger, thus not affecting clamping force.

All parts easily replaceable.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS | **LAPEER MANUFACTURING CO.**

3053 DAVISON ROAD
LAPEER, MICHIGAN

WESTERN DIV.: PECK and LEWIS CORPORATION
4436 Long Beach Ave., Los Angeles 58, Calif., ADams 3-7146

CANADIAN DIV.: HIGGINSON EQUIP. SALES LTD.
1131 Pettit Road, Burlington, Ontario

USE READER SERVICE CARD; INDICATE A-5-122

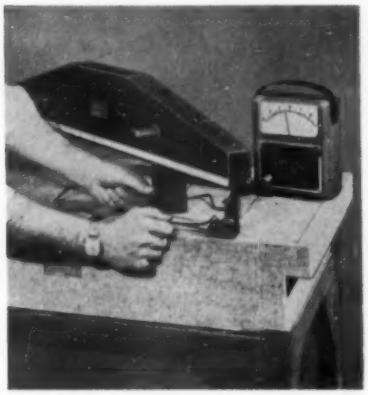
a manner that it is easily released.

Centered in the Roto-Mike faceplate is a 0.4000-in. hole, corresponding with diameter of the four sine plugs. A snug fitting plug may be placed in this central hole to supply the common stationary element of four 5-in. sine bars 90 deg apart. Each of the standard Roto-Mike's critical dimensions is accurate within 0.0002 in. When specified, individual dimensions can also be furnished to within 0.0001-in. accuracy.

Sorensen Center-Mikes, Inc., 264 Kossuth St., Bridgeport, Conn. **T-5-13**

Surface Plate Calibrator

Shop calibration of surface plates to 0.00001 in. can be accomplished with a Planekator. In the illustration it is used with an Ames Porta-Check, on a newly designed base, to calibrate a 24x-36 in. surface plate. Gage bases are



available for use with all other makes of 0.00001 in. electronic and air gage pickups or cartridges, also for all 0.0001 and 0.00005 in. indicators.

Rahn Granite Surface Plate Co., 635 N. Western Ave., Dayton 7, Ohio. **T-5-14**

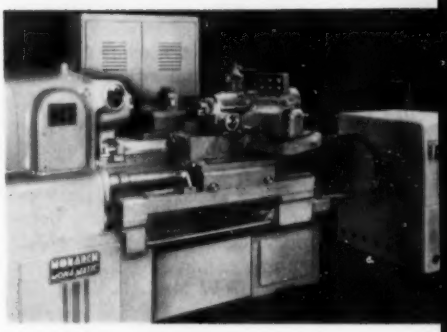
Lathe

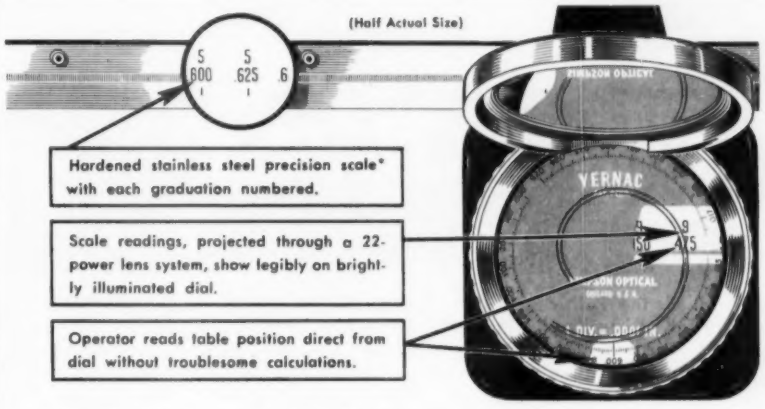
Model 20-H Mona-Matic automatic double carriage turning machine, with a 60-deg tracer-controlled front tool slide, affords variety of automatic cycling arrangements. The hydraulically powered front carriage and rear slide assure dependable performance.

The machine is available in 18, 30 and 42 in. center distance. Swing is 15 in. over front slide and 8 in. over rear slide ways. A two speed main drive motor may be applied to the helical geared headstock equipped with power clutch and brake. Eight spindle speeds are available by pick-off gears in each of three standard ranges. The tailstock has an air actuated spindle and built in, heavy duty, antifriction center.

Front carriage feed and traverse are accomplished by a cylinder mounted in the apron. Feed rates are infinitely adjustable from 1 to 40 ipm. Carriage traverse is 200 ipm. Rear slide feed rate is ½ to 40 ipm while traverse is at 90 ipm. Rear slide has an adjustable positive stop to control maximum slide travel.

Four different feeds are available to the carriage for use with a single cycle. On two-cut cycle lathes, one feed only




(Half Actual Size)
Hardened stainless steel precision scale* with each graduation numbered.
Scale readings, projected through a 22-power lens system, show legibly on brightly illuminated dial.
Operator reads table position direct from dial without troublesome calculations.
VERNAC

New optical measuring instrument assures . . .

high operating accuracy for new or used machine tools

The new VERNAC Direct Reading Optical Measuring Instrument eliminates the complexities of using end rods and gage blocks. Now, the longitudinal, lateral or vertical positioning of machine tool tables can be quickly and easily read direct to .0001". Accuracy is not affected by the wear or stretch of table movement screws. The instrument itself has no moving parts which can impair accuracy.

VERNAC instruments also up-grade machine tools to perform tasks beyond their original accuracy. For example, they can up-grade moderately priced milling machines to the accuracy of more expensive jig boring machines at a fraction of the latter's cost.

*The scale is a replica of a master certified by the U.S. National Bureau of Standards to .0001" maximum error over its entire length.

SEND FOR FREE BULLETIN. Explains how the VERNAC enables you to do more precise work on your present machine tools.

VERNAC® UNITED STATES AND FOREIGN PATENTS PENDING

Designed and Manufactured by
SIMPSON OPTICAL MANUFACTURING CO.
3202-04 Carroll Ave., Chicago 24, Ill.

Manufacturers and designers of precision optics for scientific equipment since 1926.

9215

Simpson Optical Manufacturing Company, 3202-04 Carroll Ave., Chicago 24

Send me free literature describing the VERNAC Optical Measuring Instrument.

Name

Company

Street Address City Zone State

USE READER SERVICE CARD; INDICATE A-5-123

may be employed during the rough cut, the remaining three during the finish cut. Two-cut cycle machines are provided with a selector switch for one or two cut operation.

The floor mounted hydraulic power unit stands at the tailstock end of the machine. All cycle valving is manifold mounted. Compensated feed rate controllers at the front of the unit permit presetting of each feed for front carriage and rear slide.

The Monarch Machine Tool Co., Sidney, Ohio. **L-5-15**

Inspection Table

Location of holes in templates, jigs, fixtures and other flat sheet metal work can be checked quickly and accurately with this inspection table. The X and Y coordinates from two edges of the sheet are read optically directly from decimally graduated scales. These dimensions may be read in 0.0005-in. increments at the rate of one to three holes per minute. The mechanical method is fast, positive and accurate without depending on highly skilled operators.

Material up to 36 x 42 in. may be inspected without angle plates, verniers, height gages, indicators or other such equipment, and no compensating figures or other calculations are necessary.

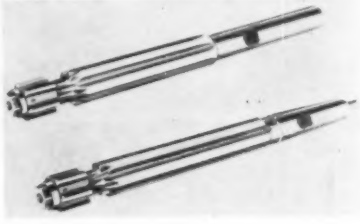
In use, the work is secured to the table top against locating edges, using quick acting clamps. The carriage,

with the optical scanners and X and Y scales, travels freely over the table. The operator inserts the stylus into each hole to be inspected, and reads the center-line dimensions from the edges of the sheet. The scales are graduated to 0.050 in., and the scanner is used to read the hole location to 0.0005 in.

Wiedemann Machine Co., Dept. 833, Gulph Rd., King of Prussia, Pa. **L-5-16**

Expansion Chucking Reamer

This carbide tipped expansion chucking reamer incorporates a replaceable shell that can be expanded to compen-



sate for wear during use. The shell type cutting element can be readily replaced when the shell is worn out.

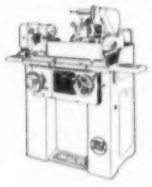
When the reamer needs expanding to offset wear, the shell is merely driven further onto the tapered arbor. Additional cutting clearance automatically is provided by expansion of the shell. The reamer will expand uniformly on all cutting edges; ordinarily there is no

MSO Since 1865

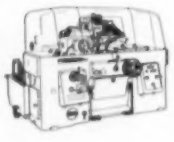
SOLVES Grinding Problems

This is the 94th consecutive year of MSO leadership in the development of improved grinding methods.
MSO offers unequalled precision in the most advanced grinding machines available anywhere.
Today, when your grinding problems are more complex than ever before, MSO, as always is one step ahead with the solution.

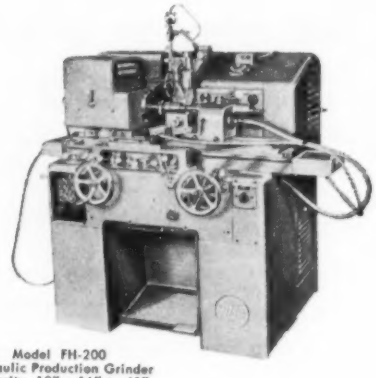
The MSO line comprises a full range of Plain and Universal Grinders, Cap. 7" x 12" to 22" x 138".



MODEL FMES UNIVERSAL GRINDER



MODEL GA-2 HYDRAULIC THREAD GRINDER



Model FH-200
Hydraulic Production Grinder
Capacity: 10" x 16" to 40"

FEATURES:
- Rapid traverse to wheelhead
- Equipped for traverse and plunge-cut grinding
- Selection of 4 automatic cycles with fine finishing feed, adjustable spark-out and automatic cut-out
- Manual and automatic table and wheelhead movement
- Fine feed to .0001" by quick lever trip
- "Precimatic" electric grinding gauge sizes to .0001"

austin industrial corporation
76-V Mamaroneck Avenue White Plains, New York

AUS-39a

USE READER SERVICE CARD; INDICATE A-5-124

need for grinding after expansion.

The grooved rear pilot of the reamer is ground 0.0002 to 0.0004 in. smaller than the cutting diameter. Where piloting is not needed, it can be supplied 0.010 in. undersize.

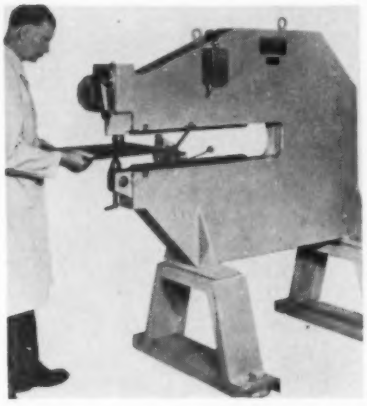
Reamers are available with straight or tapered shanks in stock sizes from ½ to 1½ in. diam. in 1/16-in. steps. Replacement shells are available in the same range. Both reamers and replacement shells are available in special and decimal sizes.

Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio. **T-5-17**

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Notching Machines

Models P-5 and P-7 machines, which operate by means of a reciprocating upper tool and a stationary lower tool, may be used for straight, circular, in-



side, irregular, slot and louver cutting as well as beading, joggling, flanging, edge bending, dishing and nibbling.

Capacity of the Model P-5 is 7/32 in., and the P-7 is 9/32 in. in mild steel.

American Pullmax Co., 2455 N. Sheffield Ave., Chicago 14, Ill. **T-5-18**

Bevel Cutting Attachment

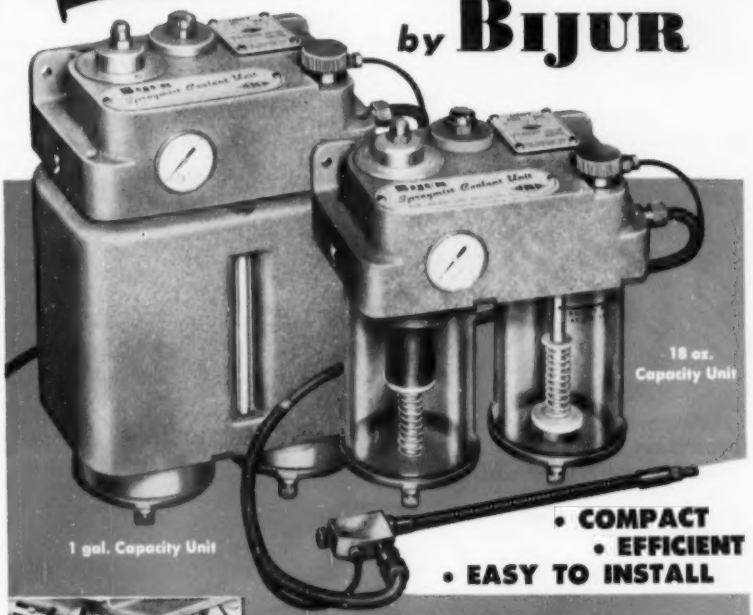
An attachment designed for bevel cutting with a machine torch enables an operator to change cutting angle without extinguishing the flame. The SC290 attachment is calibrated in increments of 15 to 90 deg on each side of vertical to permit cuts at most angles. Absence of stops on the swivel member permits reverse beveling.

Flexible seal rings imbedded in machined grooves keep the gases separated until they mix properly in the tip. They also allow hand adjustment of the head, as well as protecting the seat

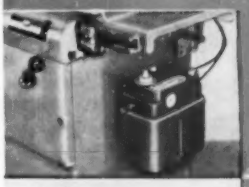
NOW . . . ENGINEERED MIST COOLANT EQUIPMENT!

Spraymist®

by BIJUR

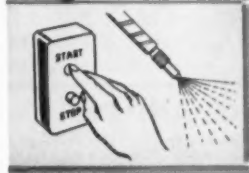


• COMPACT
• EFFICIENT
• EASY TO INSTALL



Compact Integral Unit Design includes built-in air filter, trap, regulator, gauge, solenoid valve, conduit box, pressurized reservoir, and coolant filter. No unsightly plumbing, extra valves or controls!

Individual Jet Control. Precision needle-valve control permits a range of settings from superfine mist to heavy spray. Unique Spraymist design forms the mist *in the jet tip*, not the tube. There's no flooding, sputtering or condensate drip! One Spraymist unit can supply up to 10 or more jets by branching from existing lines.



Automatic Operation saves time and trouble. Solenoid valve, connected to machine circuit, starts Spraymist when machine is turned on. Pressurized reservoir, built-in regulator insures positive air supply, and save shop air. No need for manual air valves!

Extremely Adaptable. Use Spraymist on toolroom and production machines. Standardized components make installation and maintenance *easy*. Choose from 2 reservoir capacities, 3 solenoid ratings, 3 types of jets. Full assortment of hose assemblies and T-blocks for branching. Replaceable jet tips are inexpensive, install in seconds.

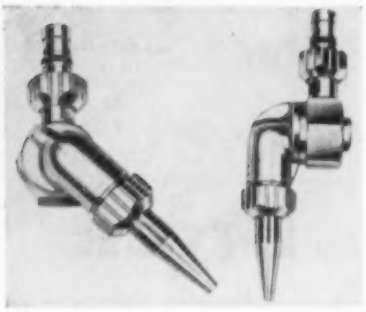
SPRAYMIST . . . The modern, compact way to get all the advantages of mist cooling.

Write today for bulletin.

A Product of **BIJUR** LUBRICATING CORPORATION

Rochelle Park, New Jersey

USE READER SERVICE CARD; INDICATE A-5-125



from damage by foreign matter.

Head of the attachment can be swiveled through its entire arc without extinguishing the preheat flame. It also can be changed from bevel to vertical cutting and back again without a need for flame adjustment. For straight line cutting of metal up to ⅜ in. thick, the tip can be angled forward up to 30 deg to increase speed.

Smith Welding Equipment Corp., 2633 Fourth St., S.E., Minneapolis 14, Minn. **T-5-19**

Throwaway Inserts

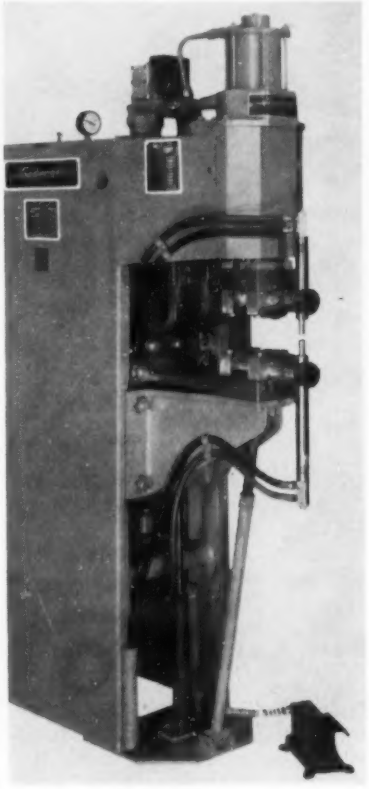
With Dowd throwaway inserts, available in carbide and high-speed steel, round, square and triangular shapes, negative holders can be used for positive cutting rakes. On triangle inserts, there are six positive cutting edges; on square inserts there are eight. A mechanical chip breaker is used as a clamp, and there is no need to adjust it when indexing the insert.

The inserts, which can be obtained in right or left-hand cuts, afford 20 to 30-deg top rake for machining aluminum, copper, brass or magnesium and 10 to 15 deg for stainless steel.

Kay-Dan Co., Orange, Mass. **T-5-20**

Press Welder

Each size in the standard line of press type resistance welders is available as a spot welder, a projection welder or a combination spot and projection welder in a range of standard



throat depths, electrode forces and transformer sizes. The line is available in four sizes ranging from 30 to 500 KVA inclusive.

A few of the new design features are: one-piece frame, takes less floor space, gives greater working area; new anti-friction slide, easily adjusted for wear

HOW TO FIGURE PRESS FEEDING

Economy!

UNIT COST DOWN, PROFITS UP! WITH DICKERMAN AUTOMATIC PUNCH PRESS FEEDS . . . AND HERE'S THE REASON WHY . . .

Hand Feeding . . .

8 hrs. @ 2000 pieces/hr. 16,000

Labor @ $1.60 hr. $12.80
Cost per M pieces —

80¢

with Dickerman Feeds (83% press efficiency)

8 hrs. @ 100 RPM x 60 48,000

Labor @ $1.60 hr. $12.80
Cost per M pieces —

22½¢

Dickerman Press Feeds don't get tired. Dickerman Press Feeds produce — and keep on producing — 24 hours a day if necessary without let-down, human error. Downtime is negligible—even on million plus runs.

Dickerman Press Feeds mean real savings, real gains. Dickerman Feeds cost little to install — pay for themselves in days — pay profits year after year AND as Dickerman Feeds will operate at any speed the tooling will withstand, unit cost drops as production increases. For automation . . . For new economy . . . install dependable Dickerman Feeds on all your press equipment now!

TOOL AND DIE DESIGNERS . . . .

Full scale templates on all Dickerman Hitch Feeds®, Die Feeds and Rol-Di-Feeds available upon request.

SEND today for catalogs on the complete money-making Dickerman line.

Dickerman

H. E. DICKERMAN MFG. CO.

321-330 Albany Street • Springfield, Mass.

USE READER SERVICE CARD; INDICATE A-5-126

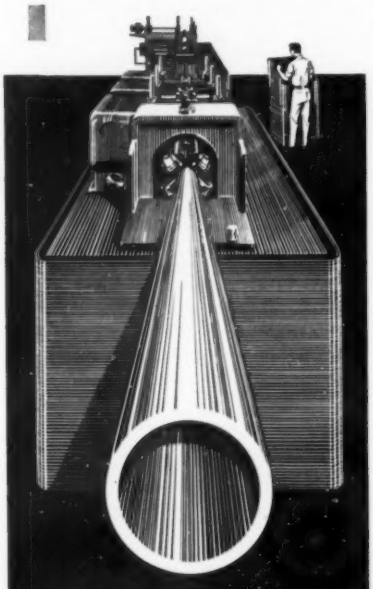
YODER

Pipe and Tube Mills

Product dependability—integrity of manufacture—engineering for specific production needs have all contributed to establish Yoder equipment as the industry standard of excellence. Since 1909 Yoder-built machinery, including Pipe and Tube Mills, Roll Forming Equipment and Rotary Slitters, have earned world-wide customer satisfaction and recognition.

Profit from Yoder's years of engineering and service experience. Send today for the illustrated Yoder Pipe and Tube Mills Book.

THE YODER COMPANY
5525 Walworth Ave., Cleveland 2, Ohio



ENGINEERING YODER MANUFACTURING

PIPE AND TUBE MILLS
(ferrous or non-ferrous)
COLD ROLL FORMING MACHINES
ROTARY SLITTING LINES

INDICATE A-5-127-1

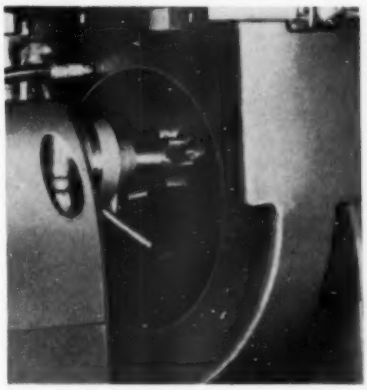
or take-up, no covers to be removed. Integral transformer and lower arm give high performance and maximum power efficiency.

The Federal Machine & Welder Co., Warren, Ohio. **T-5-21**

Gear Shavers

A rotary gear shaving process for precise control of surface finish, profile and lead on gears having 12 or less teeth utilizes external-gear type rotary shaving cutters.

Cutters are made in the form of an internal helical gear, which provides



increased surface contact between the cutter and work gear profiles.

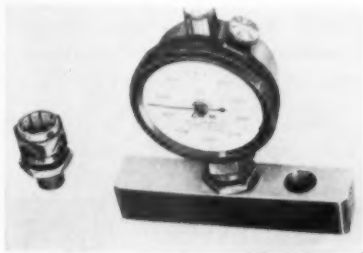
Application of this process requires that the work gear drive the cutter.

National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. **T-5-22**

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Depth Gages

Pet-line depth gages utilize a spring collet for quick assembly and adaptability. The collet also can be used separately for mounting dial indicators to other gages. Having a 3/8 in.-32 thread, the spring collet will accommodate any A.G.D. dial indicator. Also supplied individually, the collets are useful for mounting dial indicators on fixture gages and plate or angle blocks, or on bars used as depth gages for

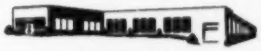


NEED TUBULAR RIVETS IN A HURRY ?

NEW ENGLAND DIVISION
Milford, Connecticut (Trinity 8-1761)

PENN DIVISION
Hatboro, Pennsylvania (Osborn 5-4560)

ILLINOIS DIVISION
Aurora, Illinois (Aurora 2-4278)



OHIO DIVISION
Elyria, Ohio (Fairfax 3-3177)

PACIFIC DIVISION
Norwalk, California
(Phone Whittier: Oxford 3-3777)

5 MILFORD MANUFACTURING PLANTS

are within overnight trucking distance of your assembly line.

To give you unmatched service on tubular rivets, Milford has five manufacturing plants and twenty sales offices strategically located across the country's industrial beltline.

For the answers to delivery problems . . . *get in touch with Milford first!*

THE MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • HATBORO, PENNA
ELYRIA, OHIO • AURORA, ILL. • NORWALK, CALIF.

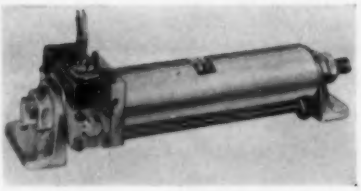
INDICATE A-5-127-2

large diameter holes.

Available in various models to check center or off-set depths, the gage provides a fast method of checking depths of holes, recesses, slots, etc.

Petz-Emery, Inc., Pleasant Valley, N.Y. **T-5-23**

Air Cylinder



Directional and exhaust speed control valves are built into these Valve-In-Head air cylinder. Designated as the VIH Series, the units are available in 1½, 2 and 3-in. bore sizes in any stroke length. Directional control valve actuation can be solenoid, remote pilot pressure, button-bleeder, or combination solenoid-button bleeder. Mountings are interchangeable.

Independent exhaust speed controls are built in; threaded exhaust ports permit piping exhaust air for chip blowing, parts ejection, etc. Solenoid-operated models have single conduit connection for double solenoid units, and plug-in solenoid coils which permit replacement or changing to different voltages without disconnecting wiring or piping.

Modernair Corp., 400 Preda St., San Leandro, Calif. **T-5-24**

Cutoff Saw

Model M-750, 16-in. cutoff saw cuts ferrous and nonferrous metals at a rate of two to four seconds per square inch to tolerances of less than 0.010 in. Resultant finish often requires no subsequent operations. The cuts produce no change in characteristics or hardening of metals.

A geared-in-head motor delivers maximum power to spindle with no loss of speed or power due to belt slippage. A self-centering vise is adjustable for accurate angle cutting up to 46 deg.

The saw is available for manual, semiautomatic and fully automatic operations.

Stone Machinery Co., Inc., Manlius, N.Y. **T-5-25**

Multispindle Honing Machine

This BarnesdriL Model No. 4014 3-spindle vertical honing machine incorporates individually controlled pneumatic hone feed for each spindle. Hone feed pressure can be calibrated for each spindle to compensate for varying operating conditions caused by bore size irregularities and different degrees of stock hardness.

Proper control of hone feed pressure assures close bore size tolerances. Pressure control on the honing stones in each tool avoids rapid stone wear

Buck
Ajust-Tru® Gibbed Keyway
POWER CHUCK
with Aluminum Body

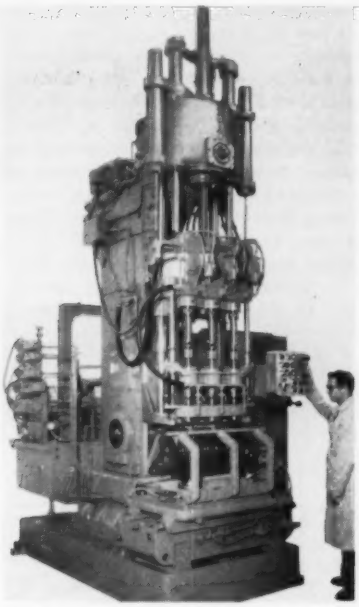
40%
weight saving
★
precision within
.001"
★
Adjusts under
full air pressure
★
GIBS
TAKE UP
WEAR

Those features—plus precision top jaw machining *in the tool room* (with Buck jaw-turning fixture) — give you production advantages you've never had before.

There is less down time, greater accuracy. 40% less weight means that chuckers start quicker, stop quicker, with less brake wear. 40% lighter jaws means less centrifugal force, surer grip at high speeds. And gibs to take up wear should *triple the useful precision chuck life.*

Send for complete facts. See why *"It pays to chuck with Buck."*

BUCK TOOL COMPANY
833 SCHIPPERS LANE • KALAMAZOO, MICH.
USE READER SERVICE CARD; INDICATE A-5-128



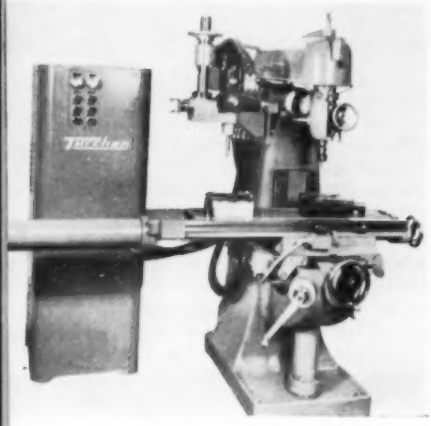
caused by cutting induced by inter-tool pressure variances. As a result coarser stones can be used for faster stock removal while holding close surface finish tolerances.

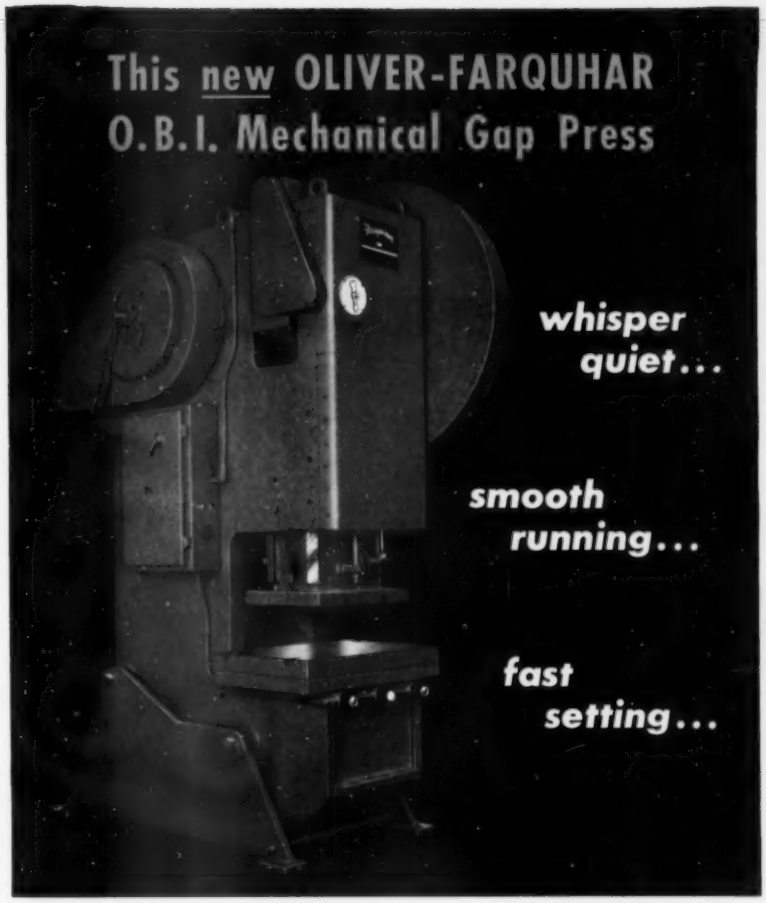
Production is 32 blocks per hour at 80 percent efficiency. Finish requirements maintained are within 25-35 microinches.

Barnes Drill Co., 870 Chestnut St., Rockford, Ill. **T-5-26**

Die Sinker

The Recipro-Matic automatic die sinker combines automatic feed rate control, reciprocation, depth control and indexing or pick-feed. This last is infinitely adjustable for rough, semi-finish or finish operations. The cycle is interchangeable for either longitudinal or transverse feeds. After workpiece and model are set up and the machine adjusted to the job, the operation is





for dependable high production

You'll want new Oliver-Farquhar O.B.I. Mechanical Gap Presses for blanking, forming, drawing, bending and assembling operations. Designed and built into these O-F presses are features such as these . . .

- Rigid welded rolled steel frame with side members of uniform thickness.
- Box type slide construction with long gibs and gibways—constant, dependable alignment.
- Pneumatic counterbalance cylinders—slides and dies "float" to reduce shock.
- Continuously rotating low inertia type clutch—higher cycling, cooler operation, low maintenance.
- Adjusting screw fully-guided, large-diameter, long-barrel type—easy adjustment at floor level.
- Built to J. I. C. (Joint Industry Conference) Standards—for in-service uniformity.
- Available in four models—75, 110, 150 and 200-Ton capacities.

Write, wire or phone for complete details on the new, heavy-duty, Oliver-Farquhar O.B.I. Mechanical Gap Presses now available for delivery.

A. B. FARQUHAR DIVISION
The Oliver Corporation
Press and Special Machinery Departments
York 90, Pennsylvania

OLIVER Farquhar PRESSES

Also Manufacturers of Farquhar Conveyors

USE READER SERVICE CARD; INDICATE A-5-129

automatic and no operator is required.

The tracing stylus follows the shape of the master; deflection of the stylus remains the same and produces uniform and accurate cuts.

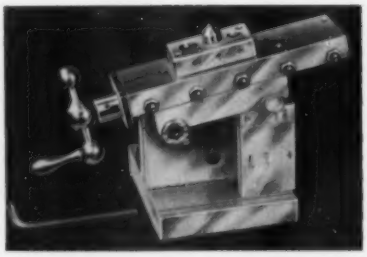
Adjustable stops, operable either from the motion of the table or the knee, trip a table-reversing valve at the end of each stroke and simultaneously an index motor cross-feeds the work for a new cut. The cross feed is infinitely adjustable. By proper setting of the stops, the operator can prevent wall climbing by the tracer.

The tracer control valve permits instant change-over to a 360 deg. contouring operation for complex parts.

Turchan Follower Machine Co., P.O. Box 657, Inkster, Mich. **T-5-27**

Sine Dresser

Made for use with standard gage blocks and sine tables, the diamond holder block of the Matco sine dresser has 2 in. of travel and is moved across the grinding wheel by a screw feed actuated by a hand knob. There is no chatter. The dresser can be adjusted beyond 45 deg. up or down, for dressing wheels to almost any desired angle.



The split type hinge roll locks positively at any angle. The diamond holder block can be mounted in two positions and has three hole sizes to accommodate standard diamond mountings. Overall height, without the diamond is 4⅞ in. By removing the diamond holder, the dresser can be used as a checking fixture.

Matco Division, Dept. 145, Manting Tool & Die Corp., Morley, Mich. **T-5-28**

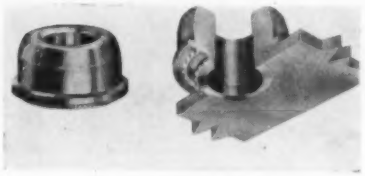
Bushings

These press type Anchor bushings (illustrated), provide a quick method for making drill templates.

They are pressed into drilled or punched holes in 0.060 in. or thicker aluminum template material. The double row of serrations at the base of the bushing body provides a positive lock to resist drill torque. Three bushing pilot sizes accommodate drill sizes #55 (0.052) through 7/16 (0.4375).

The company also has developed an anchor stop to facilitate indexing or positioning drill templates or other tooling onto the work prior to drilling or other fabricating operations.

The Anchor stop has a ½-in. diam-

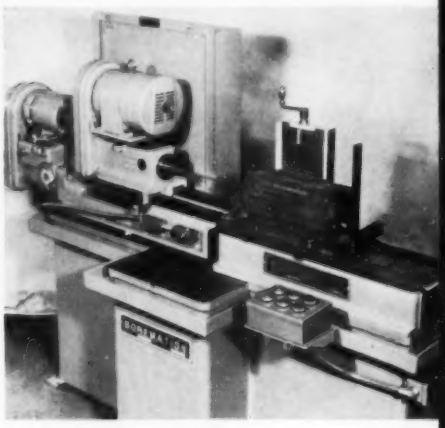


eter and can extend beyond the template surface at heights from 0.125, 0.187, 0.250, 0.312 to 0.375 in.

Hi-Shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif. **T-5-29**

Gun Drilling Machines

Feed range of this series of gun bore drilling machines is infinitely adjustable and extends from ½ to 30 ipm. Spindle speeds range from 100 to 10,000 rpm. Selection of any feed or speed is controlled by the operator; the feed

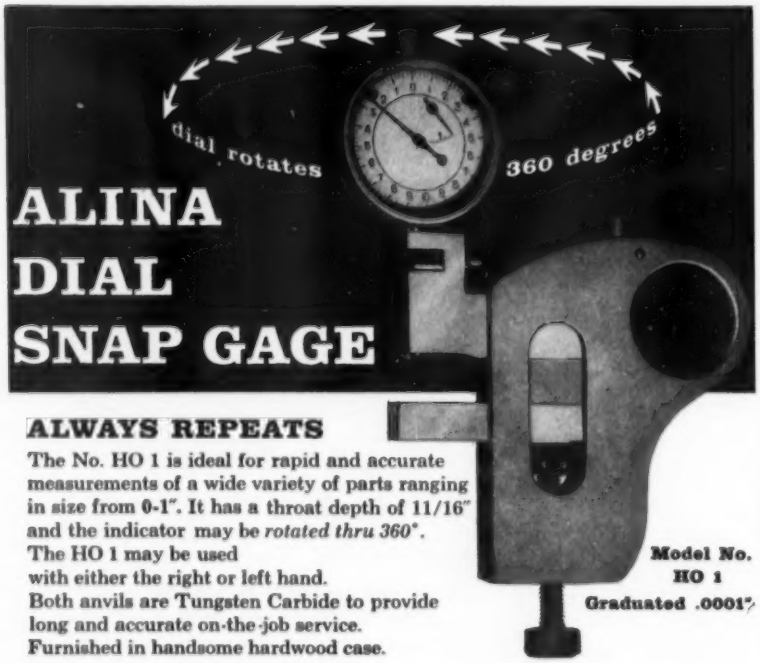


and speed selected are held constantly once the adjustment is made.

The machines are available in two standard sizes; 12 in. stroke (Model 1200) and 24 in. stroke (Model 2400).

They are equally adaptable for high production cycle, short hole drilling, maintaining the desired hole tolerances in one pass. With a mechanical stop attachment, hole depths can be repeated within 0.001 in. in most cases with either single, dual or multiple spindles.

Drillmation Co., Inc., 6500 E. Eleven Mile Rd., Centerline, Mich. **T-5-30**



ALWAYS REPEATS

The No. HO 1 is ideal for rapid and accurate measurements of a wide variety of parts ranging in size from 0-1". It has a throat depth of 11/16" and the indicator may be *rotated thru 360°*. The HO 1 may be used with either the right or left hand. Both anvils are Tungsten Carbide to provide long and accurate on-the-job service. Furnished in handsome hardwood case.

Model No. HO 1
Graduated .0001"

WRITE FOR LITERATURE AND COMPLETE CATALOG.

ALINA CORPORATION
122 East Second Street, Mineola, L. I., N. Y.

USE READER SERVICE CARD; INDICATE A-5-130

Marking Press

Equipped with shuttle feed and stackers, the Model 10-T Pneumark bench press becomes a high production nameplate marker. Mounted horizontally and equipped with special fixtures, it handles a wide range of part sizes. A dial feed with eight stations also is available to speed up marking operations. Where a variety of components in small lots are to be marked, simple fixtures and gages can be used.

Rated capacity of the tool is 10 tons; line pressures from 20 to 100 pounds can be used.

Geo. T. Schmidt, Inc., 4100 N. Ravenswood Ave., Dept. TE, Chicago 13, Ill. **T-5-31**

Cutoff Saw

This cutoff saw is capable of length accuracy and cut parallelism within 0.003 in. with an unskilled operator. Design of the tool incorporates spindle and vise as integral parts of the same

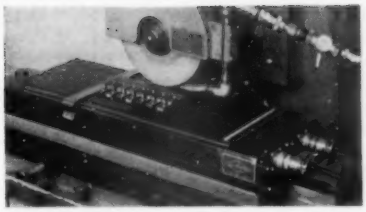
casting. Special machining and checking methods permit final alignment of cut to within 0.001 in. in all planes of the cutting operation. It will cut accurately most ferrous and nonferrous metals, plastic and wood with the use of only two different blades and a fixed rpm.

Navan Products, Inc., subsidiary of North American Aviation, 900 N. Sepulveda, Los Angeles, Calif. **T-5-32**

USE READER SERVICE CARD ON PAGE 135 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electrostatic Chucks

Any electrical conductor can be held on this electrostatic chuck. It also will hold ceramics or plastics if the holding surface is "flashed" with a metallic coating as little as five millionths of an



inch in thickness.

Basic equipment units in the system consist of the chuck itself (which is designed for use on standard surface grinders or adaptable to many special requirements), a compact power supply which may be located adjacent to the machine, a "Dri-box" in which the work is kept moisture-free at slightly above room temperature, and a coolant pump and filter unit to furnish a supply of clean dielectric coolant. Work is instantly gripped and released by simple control switch. There is no residual magnetism with this system, even when used with ferrous materials.

Equipment operates on standard 110 volt, 60 cycle single phase current from a 3-wire grounded circuit.

Electroforce Inc., Fairfield, Conn. **T-5-33**

Air Motor

An air cylinder and electrically actuated control valve with built-in speed controls are incorporated in a single air power package. Installation requires a single air line connection and simplified wiring to the solenoid-actuated,

ARMSTRONG

Drop Forged CLAMPS

LEADERS IN THE DROP FORGED CLAMP FIELD

. . . in design, machining and strength; in completeness of line in both sizes and types.

Designs are based on a full knowledge of clamp uses and requisites. Drop forging assures die-perfect form, texture toughness and freedom from structural faults. Maximum stiffness is attained by a discerning selection of steels with accurate controlled heat-treating, tempering and testing.

For dependability and long useful life, specify and standardize on ARMSTRONG Drop Forged Clamps.

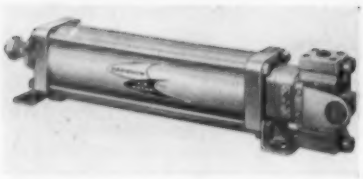
Write for new ARMSTRONG General Catalog showing almost 5000 industrial tools

ARMSTRONG BROS. TOOL CO.

5247 W. ARMSTRONG AVE. • CHICAGO 46, ILL.

Buy ARMSTRONG TOOLS from your Industrial Distributor

USE READER SERVICE CARD; INDICATE A-5-131



pilot-operated valve.

The compact, square head cylinder has a rust-proof body. The control valve is of a reciprocating disk design that will operate even when the valve is blanketed by chips or grinder dust, or when splashed with coolant. Easily adjusted speed controls are built into the 4-way valve port plate and provide accurate adjustment of cylinder piston speed in both directions.

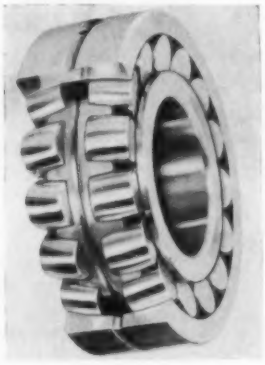
Hannifin Co., Dept. 120, Des Plaines, Ill. **T-5-34**

Spherical Roller Bearings

High capacity spherical roller bearings offer maximum diameter and quantity of convex rollers for each bearing size, precision machined centrifugally cast bronze retainers. All components are in optimum balance.

Bore sizes of series 22200 and 22300 range from 1.5748 to 11.0236 in. with dynamic load ratings to to 288,000 lb. The bearings also will be available in pillow blocks in bore sizes ranging from 1 7/16 to 10 in.

High, heavy inner race shoulders make it possible to assemble or remove



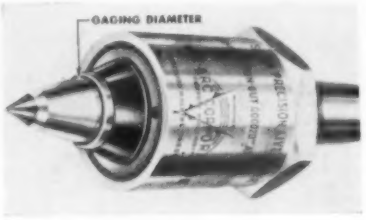
bearings easily from shafts with conventional shop equipment.

Pillow blocks are available with either multilabyrinth or Dacron contact seals. Both seals retain lubricants and exclude contaminants, are interchangeable and easily assembled into housings.

Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill. **T-5-35**

Live Center

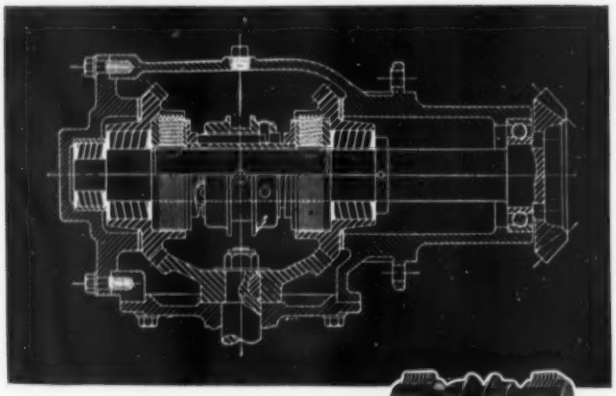
A "gaging" diameter has been incorporated in the spindle of these Super-Precision live centers. This diameter runs true with the carbide nib well within 0.000015 in. Inaccuracy of workpiece center holes can be checked

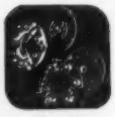


by placing the workpiece between centers and checking the "gaging" diameter with a high-sensitivity indicator as the workpiece is slowly rotated. Thus any runout in excess of 0.000015 in. is an indication of degree of workpiece center hole error which, if not corrected, will result in equivalent error in the workpiece.

Vee-Arc Corp., Dept. N-385, Westboro, Mass. **T-5-36**

ROCKFORD





Small Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

Multiple-Disc • Single or Double • Oil or Dry Type

PULLMORE CLUTCHES

Provide

POWERFUL ENGAGEMENT WITH HIGH-RATIO LEVERS

High-ratio operating levers give PULLMORE clutches powerful engagement with slight axial pressure and short movement of the shifter spool; consequently operation is quick and easy. Declutching is equally fast and positive. The shifter spool has an extra deep slot which is hardened and ground. This prolongs the life of the clutch, reduces wear on the shifter fork and holds run-out to a minimum.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER-TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

B/W

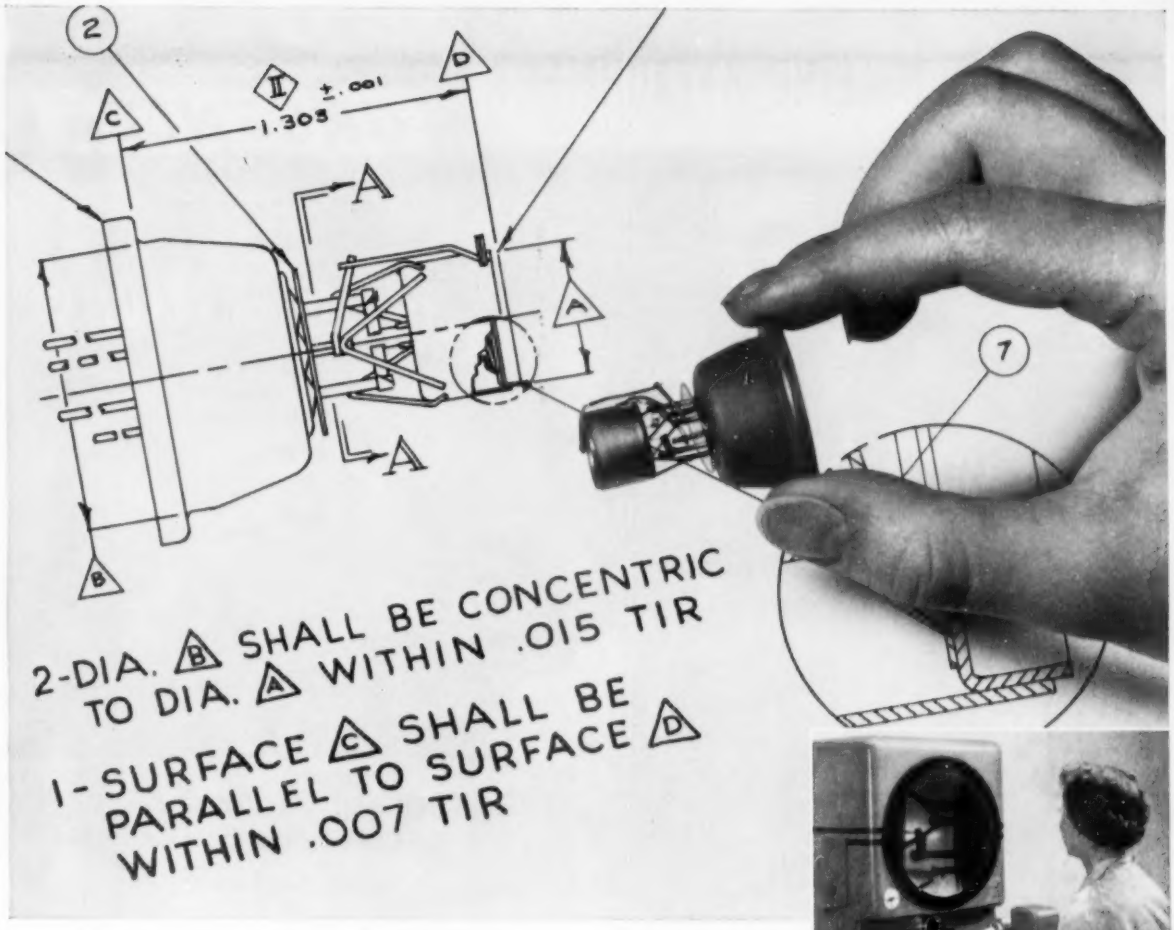
ROCKFORD Clutch Division BORG-WARNER

1329 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

USE READER SERVICE CARD; INDICATE A-5-132



"We can cut out up to 20 gaging operations on delicate parts like this."

"Many times, with a single chart and fixture on our Kodak Contour Projector, we can quickly inspect several complex part dimensions at a single pass. This cuts gaging operations and costs to a fraction of the cost of separate gaging checks," says Varian Associates of Palo Alto, Calif., makers of precision electronic parts and equipment.

No contamination of or pressure on delicate parts (a light beam exerts no pressure, causes no wear); high-speed, accurate inspection of close-tolerance dimensions; few mechanical operations . . . these are only some of the reasons why manufacturers like Varian find optical gaging with the Kodak Contour Projector the most practical solution to many inspection problems.

You get more with a Kodak Contour Projector. You get greater *working distance*—8" of clearance for parts and fixtures. Especially important at high magnifications.

You get more brilliant, more uniform *illumination* over the entire screen area—at all magnifications.

You get highly *accurate images* even at the critical outer edges of the screen area.

You get *upright images* of all inspected parts for easier reference.

These and other features of the Kodak instrument make it more efficient and more valuable to you. Read about them by writing for the booklet, "Kodak Contour Projectors."

SPECIAL PRODUCT SALES

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

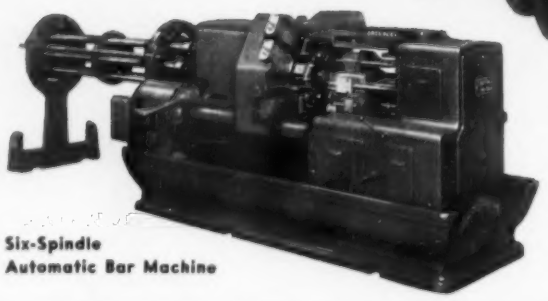
THE KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

GREENLEE MILLING ATTACHMENT

PRODUCTION MACHINERY

GREENLEE



Six-Spindle
Automatic Bar Machine

Mounts on Main Tool Slide

The Greenlee milling attachment eliminates second operation milling on many jobs. Two millers, normally mounted in 3rd and 4th positions, can profitably mill squares or double slot end of work piece at bar automatic speeds. The cutter head rotates at the same RPM as the work piece. Cutter speed is independent of spindle speeds. The Greenlee milling attachment is only one of many versatile standard and special attachments that expand your job range . . . increase your profits. Find out how Greenlee attachments can help you. Get the details from your Greenlee Distributor.

Write for your copy of Catalog A-405 — first step on the way to more profitable production with Greenlee Automatic Bar Machines.

OTHER GREENLEE ATTACHMENTS AVAILABLE

- Eccentric Boring
- Eccentric Drilling
- Eccentric Forming
- Eccentric Turning
- Crimping
- Gear-Fed Reaming
- Relieved Type Facing
- Thread Rolling
- Broaching
- Trepanning
- Hollow Milling
- Burring

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines
- Die Casting Machines

GREENLEE
BROS. & CO.

1754 MASON AVE.
ROCKFORD, ILL.

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

A-S-121—Drill Bushings—*Accurate Bushing Co.* Lift swing tooling suggestions described in bulletin LS-58. (Page 122)

A-S-143-1—Drills—*Ace Drill Corp.* Catalog describes entire line of Ace high-speed steel and carbide drills, reamers, drill blanks and special drills. (Page 142)

A-S-138—Scroll Chuck—*Allen Corp.* Details on Allen scroll chucks and complete catalog now available. (Page 138)

A-S-262—Tool Steel—*Alleghany Ludlum.* Cast-to-Shape tool steel information available in booklet FC-4, a 28-page technical discussion of A-L's forging and casting division. (Page 262)

A-S-146-2—Optical Inspection—*American Cystoscope Makers, Inc.* Booklet provides practical information on use of the A.C.M.I. Borescope. (Page 146)

A-S-8—Drill Bushings—*American Drill Bushing Co.* Catalogs contain complete information on drill jig bushings for plastic tooling. (Page 8)

A-S-10—Radial Drill—*The American Tool Works Co.* Complete data on American Hole Wizard available in bulletin No. 224. (Page 10)

A-S-127—Coolant—*Anderson Oil and Chemical Co., Inc.* Sixteen page illustrated catalog describes Lunol and other Anderson metalworking products. (Page 127)

A-S-144—Metal Cutting Saws—*Armstrong-Blum Mfg. Co.* Latest cutting tool bulletin on Marvel metalcutting saws now available. (Page 144)

A-S-131—Clamps—*Armstrong Bros. Tool Co.* General catalog has details on almost 5000 industrial tools. (Page 131)

A-S-151—Optical Tooling—*Bausch & Lomb Optical Co.* Catalog D-255 contains engineering data on Bausch & Lomb DR-25 optical gage. (Page 151)

A-S-207—Taps—*Bay State Tap & Die Co.* Detailed information on assembly type taps described on page 16 of Bay State catalog No. 56. (Page 207)

A-S-20—Air Motor—*The Bellows Co.* Basic data on the use of air equipment available on data sheets containing wiring diagrams, insulation details and equipment lists on industrial operations. (Page 20)

A-S-215—Gages—*Besly-Welles Corp.* Catalog contains complete information on full line of Besly CP-75 hard chrome plated gages. (Page 215)

A-S-125—Coolant System—*Blue Lubricating Corp.* The advantages of mist cooling discussed in new bulletin. (Page 125)

A-S-251—Power Transmission—*Boston Gear Works.* Catalog lists 1400 types and sizes of power transmission products. (Page 252)

A-S-270-1—Socket Screws—*The Bristol Co.* Complete data on Bristol Dyna-Mite button-head and flat-head socket screws now available. (Page 270)

A-S-150—Milling Cutters—*Brown & Sharpe Cutting Tool Div.* New Condensalog has easy to use specifications and prices on over 5,000 standard cutters and end mills. (Page 150)

A-S-152-3—Low Temperature Alloys—*Cerro De Pasco Sales Corp.* "How to" booklet No. 34 illustrates and lists 13 useful and cost saving applications. (Page 152)

A-S-4—Drills—*Cogsdill Drill Co., Inc.* Catalog 759 has complete line of Cogsdill drills and engineering data including drilling information on wet materials. (Page 4)

A-S-149—Diamond Dressers—*Arthur A. Crafts Co., Inc.* Catalog of diamond dressers has full prices, specifications and information about resetting Crafts diamond dressers. (Page 149)

A-S-25—Hydraulic Press—*Denison Engineering Div., American Brake Shoe Co.* Descriptive catalog has complete data on multipress line. (Page 25)

A-S-152-1—Plastic Tooling—*Dexcon Corp.* Free bulletin describes applications of plastic steel to save time and cut maintenance costs. (Page 152)

A-S-21—Boring Tools—*DeVlieg Microbore Div., DeVlieg Machine Co.* Technical four page brochure has data on microbore tooling system for boring facing and spot facing. (Page 21)

A-S-171—Band Saws—*The DoAll Co., Inc.* Illustrated case histories of job savings made by contour-matic band saws over former methods available on request. (Page 171)

A-S-25—Tooling Plate—*Dow Chemical Co.* Magnesium tooling plate manual has information on shop working characteristics, properties and design for magnesium tooling plate and tubing. (Pages 24-25)

A-S-148-2—Thread Chasers—*The Eastern Machine Screw Corp.* Data on insert chasers and copy of "Unified and American Screw Thread Digest" available on request. (Page 148)

A-S-133—Optical Comparators—*Eastman Kodak Co.* Booklet "Kodak contour Projectors" discusses features of Kodak instrument for more efficient application. (Page 133)

A-S-145—Cutting Tools—*Eclipse Counterbore Co.* Complete information on cutting tools contained in catalog No. 11. (Page 145)

A-S-142—Belt Grinding—*Engelberg, Inc.* New bulletin contains information on centerless belt grinding machine No. 6122-HD. (Page 142)

A-S-138C—Boring Spindles—*Ex-Cell-O Corp.* Information on the complete line of Excello precision boring spindles discussed in bulletin No. 18477. (Inside Back Cover)

A-S-130-1—Optical Tools—*The Gaertner Scientific Corp.* Engineering specifications and application data on Gaertner coordinate Cathetometers described in bulletins 152-54 and 156-57. (Page 130)

A-S-134—Automatic Bar Machines—*Gerdes Bros. & Co.* Complete data on Gerdes automatic bar machines and attachments described in catalog A-58. (Page 134)

A-S-178—Cutting Oils—*Gulf Oil Corp.* Illustrated Gulfcut bulletins contain data on the right cutting oil for each particular type of machine. (Pages 176-179)

A-S-HC—Tool Grinder—*The Heald Machine Co.* Complete information on the model 4 tool sharpening machine in bulletin 3-4-3, issue 1. (Inside Front Cover)

A-S-180-2—Marking Devices—*Hoggson & Pettis Mfg. Co.* Circulars have data on the complete line of Hoggson steel stamps and marking devices. (Page 180)

A-S-184-2—Gage Components—*Huron Machine Products Inc.* Free price catalog has data on taperlock plug gage handles and blanks. (Page 184)

A-S-158—Taps—*Jarvis Corp.* Complete line of precision taps described in Jarvis tap catalog. (Page 158)

A-S-224-2—Fixture Components—*Jergens Tool Specialty Co.* 84-page catalog contains complete specifications and cost saving data on over 2000 standard fixture components. (Page 224)

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

MAY 1959

THE TOOL ENGINEER DETROIT 38, MICH.

READER SERVICE CARD

Please send me further information as indicated below:

(Mark Key Number of trade literature, tools or advertisements)

ADVERTISERS	TRADE LITERATURE	TOOLS OF TODAY
A—	L—	T—
A—	L—	T—
A—	L—	T—
A—	L—	T—

NAME _____ POSITION _____

FIRM _____ BUSINESS _____

Please Check One ☐ Firm Address ☐ Home Address } STREET _____

CITY _____ ZONE NO. _____ STATE _____

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

A-5-14—**Automatic Turret Lathe**—*Jones & Lamson Machine Co.* Data on the J & L automatic ram type turret lathe with lynn hydraulic drive described in catalog 5806. (Page 14)

A-5-148-1—**Hardness Tester**—*King Tester Corp.* Complete literature and prices on Brinnell hardness testers for irregular shapes and inside cylinders now available. (Page 148)

A-5-122—**Clamps**—*Lapeer Mfg. Co.* Complete information available on three new one-way clamps. (Page 122)

A-5-13—**High Speed Steel**—*Latrobe Steel Co.* Complete engineering specifications on double six M-2 contained in new booklet. (Page 13)

A-5-141—**Die Sets**—*Lewpco Industrial, Inc.* Master die set brochure contains complete data on ball bearing master die sets. (Page 141)

A-5-6—**Arc Welding**—*The Lincoln Electric Co.* Complete information on Lincoweld automatic submerged arc welding equipment and accessories is contained in bulletin 1200.1. (Page 6)

A-5-172—**Trepanning Tools**—*Madison Industries Inc.* Madison fact file on trepanning has data on successful applications. (Page 172)

A-5-125—**Carbide Tools**—*Metals Carbides Corp.* 76-page catalog 54-C contains complete information on Talide die products. (Page 134)

A-5-184-4—**Drill Bushing**—*W. F. Meyers Co., Inc.* Complete information on Meyco carbide inserted drill jig bushings contained in bushing catalog No. 42. (Page 184)

A-5-182-2—**Air Cylinders**—*Modernair Corp.* Catalog and prices available on VIH cylinders. (Page 182)

A-5-11—**Subland Drills**—*Mohawk Tools, Inc.* 12-page catalog illustrates multiple advantages of drilling and chamfering with subland drills. (Page 11)

A-5-36—**Thread Rollers**—*The National Acme Co.* Thread rolling on present equipment is described in bulletin NAF-57A. (Page 36)

A-5-31—**Gear Honing**—*National Broach & Machine Co.* Complete details available on hard gear honing in bulletin H-57-2. (Page 31)

A-5-131—**Form Tools**—*National Tool Co.* New 92-page catalog shows complete line of special tools for metalworking industry. (Page 131)

A-5-134-2—**Diamond Wheels**—*Norton Products, Inc.* Literature and price list available on the Distronic diamond wheels. (Page 134)

A-5-193-5—**Jig and Fixture Components**—*NorAwestern.* 16-page catalog contains complete data on jig and fixture components and clamping tools. (Page 193)

A-5-129—**Cylinders**—*Ortman-Miller Machine Co.* Bulletin 101A has engineering drawings of cylinders mounts, mounting brackets, capacity charts and other performance data. (Page 129)

A-5-13—**Air Preparation Units**—*Parker-Hannifin Corp., Hannifin Co., Division.* Complete data on combination units of Afters, regulators and lubricators contained in Crown literature. (Page 13)

A-5-173—**Tube Benders**—*Pines Eng. aering Co., Inc.* Free copies of "Pines News" contain latest data on rotary and press type machines for tube bending. (Page 173)

A-5-21—**Die Sets**—*The Producto Machine Co.* "Die Set Digest" an eight-page quarterly, contains data for designers makers and users of dies. (Page 21)

A-5-149—**Spline Roller**—*Reed Rolled Thread Die Co.* Detailed information available on Reed three cylinder die machine. (Page 149)

A-5-174—**Cylinders**—*Rivett Inc.* Catalog contains specifications and operating data on Squaremaster "100" cylinders. (Page 174)

A-5-132—**Clutches**—*Rockford Clutch Div., Borg-Warner Corp.* Bulletin shows typical installations and applications of Rockford clutches and power take-offs. (Page 132)

A-5-185—**Grinding Wheels**—*Simonds Abrasive Co.* Bulletin 25A 263 has complete data on precision grinding at high production speeds with Simonds abrasives. (Page 185)

A-5-123—**Optical Measuring**—*Simpson Optical Mfg. Co.* Free literature describes the Vernac optical measuring instrument for attachment to present machine tools. (Page 123)

A-5-119—**Expanding Locators**—*Speedgrip Chuck Div. of Ernest, Holderness & Collet, Inc.* Bulletin No. 27 has full description and technical details on Speedgrip expanding locators. (Page 119)

A-5-188-3—**Cutoff Machines**—*Stone Machinery Co., Inc.* Free folder illustrates complete line of Stone metal cutoff machines. (Page 188)

A-5-218-3—**Torque Testing**—*P. A. Stevenson Co.* Bulletin TF has complete data on torque testing fixture for determination of test sample torques. (Page 218)

A-5-144—**Honing Machines**—*Sunnen Products Co.* Bulletin XSP-5075 has 99 case histories with honing production rates. (Page 144)

A-5-144-1—**Cutting Tools**—*Super Tool Div. of Van Norman Industries, Inc.* Literature describes complete line of screw machine reamers. (Page 144)

A-5-15—**Surface Grinder**—*The Thompson Grinder Co.* Descriptive literature available on the new Thompson type D surface grinder. (Page 15)

A-5-221—**Tool Steel**—*Uddeholm Co. of America Inc.* Stock list No. 13 for tool steels now available. (Page 221)

A-5-210—**Filtration Machines**—*U. S. Hoffman Machinery Corp., Industrial Filtration Div.* Applications of individual tool and complete central filter systems for fluids contained in Bulletin FB100. (Page 210)

A-5-211—**Tool Steels**—*Universal Cyclops Steel Corp.* Brochure No. TS-101 has complete data on Lo-Air, air hardening tool and die steel. (Page 211)

A-5-189—**Valve Manifolds**—*Valvair Corp.* Information on Valvair deceleration manifolds for control of high-speed press transfer shuttles in bulletin G-3A. (Page 189)

A-5-114—**Cutting Tools**—*Vascoloy-Ramet Corp.* Uses and facts about all types of Tantung tools in booklet No. 572. (Page 114)

A-5-182-1—**Contour Bending**—*Wallace Supplies Mfg. Co.* Pictures of actual bending operations shown in Wallace "Take a Peak" book. (Page 182)

A-5-160—**Hardness Testers**—*Wilson Mechanical Instrument Div. of American Chain & Cable Co., Inc.* Catalog RT-58 gives complete details on line of Wilson hardness testing equipment. (Page 160)

A-5-201-3—**Miniature End Mills**—*Woodson Tool Co.* Catalog has complete data on all types and sizes of micro miniature end mills. (Page 201)

A-5-127-1—**Tube Mills**—*The Yoder Co.* Complete data on Yoder equipment available in illustrated Yoder Pipe and Tube Mills Book. (Page 127)

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

FIRST CLASS
PERMIT NO. 10782
(Sec. 34.9, P.L. & R.)
DETROIT, MICH.

THE TOOL ENGINEER
ASTE Building
10700 Puritan Ave.
Detroit 38, Mich.

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

Men at Work

Executives named to new posts at Pratt & Whitney Co. include JACOB J. JAEGER, former vice-president in charge of engineering, who was made executive vice-president. EDWARD J. SHAGES, who previously was vice-president and manager of the cutting tool and gage division, became vice-president in charge of manufacturing for all operations. Both men are affiliated with the Hartford chapter of ASTE.

Several engineering management appointments have been announced by Clearing, Div. of U.S. Industries, Inc. THOMAS BANNON, formerly chief engineer, was promoted to director of production engineering. JOHN CAMERON was named assistant chief engineer in charge of technical services to handle standards and service engineering as well as both welding and electrical engineering for the company.

Jack Slean (at left) is new president of Heidrich Tool & Die Corp. succeeding founder Rudolph Heidrich who retired. Mr. Slean also continues as general manager.

John R. Keates (at right) was elected vice-president in charge of sales for National Automatic Tool Co., Inc. He formerly was general manager of the Machine Tool Div.

PAUL J. REEVES was appointed vice-president in charge of sales for The Timken Roller Bearing Co. to fill the post left through the retirement of W. B. MOORE. Mr. Reeves, who joined Timken in 1929, has been advertising manager and director of sales.

Sandvik Steel, Inc. announced election of ERIC G. MESSLER as vice-president and assistant general manager of the company. Since 1955, he has been associated with Sandvik in the United States as manager of Coromant carbide sales and manager of steel sales. Previously he was vice-president of the company's Canadian affiliate, and earlier had been connected with the parent firm in Sweden. He is a member of ASTE's Paterson chapter.

EMMONS E. SMITS was appointed manager of the pneumatic division of J. N. Fauver Co., Inc. He has been occupied in the pneumatic field since 1955.

At Leland-Gifford Co. STANLEY B. DOWD was elevated from vice-president to president to succeed WILLIAM F. LELAND who became chairman of the board. Mr. Dowd is a member of ASTE's Worcester chapter.

RICHARD E. KRAFVE was elected to the recently created post of group vice-president-commercial for Raytheon Mfg. Co. He will direct and coordinate activities of those divisions engaged in manufacture and distribution of commercial and industrial projects, and also will be responsible for planning and directing commercial acquisition and expansion activities of the company. Mr. Krafve resigned as a vice-president of Ford Motor Co. to accept his new post.

At Heidrich Tool & Die Corp., general plant superintendent JULIUS A. SCHENSKY was made vice-president-manufacturing.

WILLIAM J. VALL was appointed manager of quality control and traffic of Hydreco Div. of The New York Air Brake Co. He formerly was manager of purchasing and traffic.

CHARLES E. REED has been named general manager of the Metallurgical Products Dept. of General Electric. Dr. Reed, who has been general manager of G-E's Silicone Products Dept. for the past seven years, succeeds KENNETH R. BEARDSLEE who became a consultant for the department.

In realignment of its organizational structure, which resulted in separation of its steel and carbide operations into two distinct divisions, Firth Sterling Inc. announced several personnel changes. THOMAS G. BARNES, formerly vice-president of sales, became vice-president and general manager, carbide division. R. K. HOPKINS, developer of the Hopkins process that Firth Sterling recently purchased from the M. W. Kellogg Co., was elected a vice-president and will continue to direct activities of the Hopkins operation as well as serving as chairman of the steel division's research committee. JOHN S. ROLLER, formerly manager of marketing, was elected vice-president of steel sales.

C. W. TRAUTMAN was named manufacturing manager of George L. Nankervis Co. where he will be responsible for all manufacturing in fabrication of Nankervis test equipment. Mr. Trautman formerly was manager of test equipment engineering for Bendix Products Div.

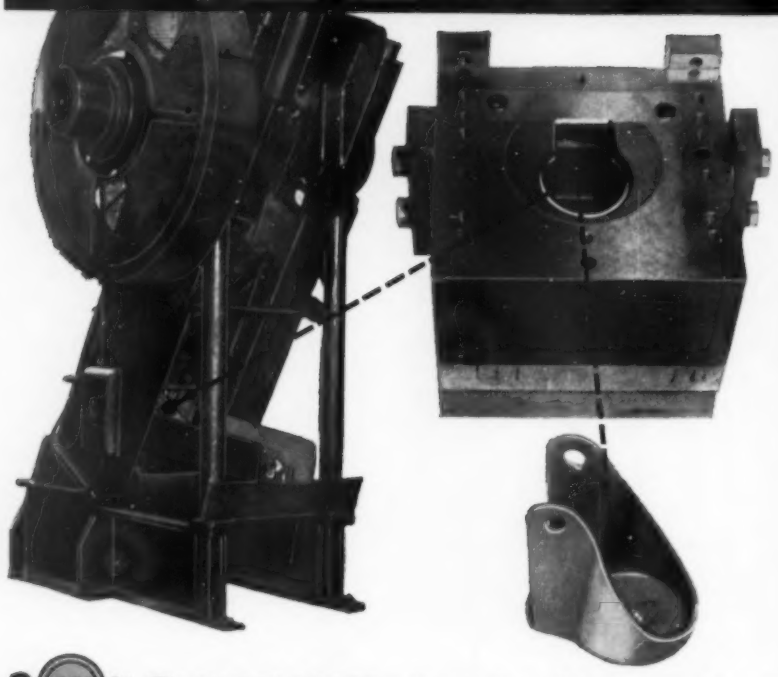
Election of RICHARD L. TANNEHILL as vice-president in charge of sales has been announced by Tube Reducing Corp. He previously was New York district sales manager for the Roots-Connersville Blower Div. of Dresser Industries, Inc.

Universal-Cyclops Steel Corp. announced appointment of FRED A. KAUFMAN to the recently created office of vice-president and general manager. Formerly vice-president in charge of the Refractomet Div., he now will be responsible for direction of sales activities and operation of the company's plants at Bridgeville and Titusville, Pa. and Coshocton, Ohio.

GLEN H. STIMSON was appointed chief engineer of Greenfield Tap & Die Div. of United Greenfield Corp. to succeed OSCAR E. KOEHLER who retired. Mr. Stimson, who has been gage sales manager and chief engineer for the gage division at the corporation since 1944, is a member of ASTE's Northern Massachusetts chapter.

NORMAN F. SPOONER was promoted from supervisor to manager of research and development for Hoskins Mfg. Co.

Talide® DIE IN SERVICE 8 YEARS DRAWS 9,000,000 CASTER PARTS!



Bassick COMPANY, Bridgeport, Connecticut, leading producer of casters, chair controls, automobile and specialty hardware, was experiencing difficulty drawing an eccentric shaped chair caster part from commercial quality hot rolled drawing steel.

Scrap rate was high—production per die low. The high-speed steel die being used (costing $350.00) had to be reground and polished every 30,000 pieces, and replaced several times a year.

A Grade C-85 Talide die (costing $1100.00) was installed in 1950 and to date has produced over 9,000,000 caster parts. During this 8-year production run, the Talide die has required no servicing and is still in operation.

Bassick Company engineers report that the quality of their product has been improved. Surface marks and scratches, caused by scoring and galling of the steel dies previously used, have been completely eliminated.

METAL CARBIDES CORPORATION
MC
TALIDE®
YOUNGSTOWN 12, OHIO
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

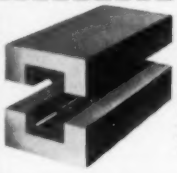
A Talide die engineer can help you cut costs and increase production on draw presses, punch presses, pill presses, cold headers, swagers and draw benches.

METAL CARBIDES CORPORATION
6001 Southern Boulevard Youngstown 12, Ohio

Send for 76-Page Catalog 56-G

WIRE DIES

Hundreds of miles of steel and non-ferrous wire—.004 to .750—drawn through TALIDE dies.



SWAGING DIES

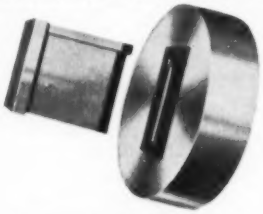
Leading fountain pen manufacturer cold swages 33 times more stainless steel parts with TALIDE dies.

HEADING AND EXTRUSION DIES

Cold heading ¼" C-1008 rivets, TALIDE dies produced 11,200,000 pieces, other carbide dies only 3,500,000.

CURLING ROLLERS

TALIDE curling rolls last 65 times longer than steel rolls on beverage can forming operation.



BLANKING AND FORMING DIES

70 times more paper discs blanked out with TALIDE—over hard alloy die.

SHEET METAL DIES

137,000 hi-alloy steel pressure vessels drawn with TALIDE against only 7,900 with steel dies previously used.

POWDERED METALLURGY DIES

Compacting highly abrasive chemical powders, TALIDE pill dies last 4 months; steel dies wore out in 6 hours.

Field Notes

American machine tools soon will incorporate calibrations in the new standardized International Inch agreed upon by directors of the standards laboratories of the United States, Canada, the United Kingdom, Australia, South Africa and New Zealand. The international standard becomes effective July 1 throughout these countries. It was adopted January 1 but a six-month grace period was given for industry to make necessary adjustments in their measuring systems. After July 1, the Bureau of Standards will calibrate all length measures and gage blocks in terms of the new figure which is 2-millionths less than the present United States inch, 1.7-millionths greater than the British Imperial inch, and coincides accurately with the Canadian inch which is equivalent to 25.4 millimeters.

moves

All operations of the Potter & Johnston Co., subsidiary of Pratt & Whitney Co., are being moved from Pawtucket, R. I. to the large, modern plant of the parent company in West Hartford, Conn. According to the official announcement, consolidation of engineering and manufacturing of the two companies will give added facilities and more efficient manufacturing techniques to the P&W line.

new facilities

A modern warehouse-service center was set up by Eutectic Welding Alloys-Northwestern Div., Inc. to serve the northwestern area industry. The center, at 2712 Second Ave. in Seattle, will be operated by Peter Nuno who will coordinate the industrial shop consultation-demonstration service of company technical representatives.

V V V

To cover western Michigan, Latrobe Steel Co. opened warehouse facilities in Grand Rapids at Elston-Richards Storage, 43 Scribner Ave., Northwest. It will stock special steel used in production of aluminum extrusion dies and support tools.

V V V

A warehouse and sales office has been established by National Cylinder Gas Div. of Chemetron Corp. at 2045 Meeting St. in Charleston Heights, S. C. to handle sale and service of industrial gases, cutting and welding equipment and other NCG products in that area as well as to provide warehouse facilities for the branch office in Savannah, Ga.

V V V

Super Tool Co., a subsidiary of Van Norman Industries, plans to have a major warehouse center operating shortly in the Chicago area. The new facility will carry cutting tool stocks in quantities equivalent to those of the Detroit plant.

new activities

A separate electronics division has been established by Lockheed Aircraft Corp. as a step in further diversifying its operations and expanding participation in military and industrial electronics markets. The division, which will be identified as the Lockheed Electronics and Avionics Div., will have temporary headquarters in the corporation's branch plant at 6201 E. Randolph St. in Maywood, Calif.

V V V

Jarvis Corp. has opened a new subsidiary in Burlington, Mass. to handle design, manufacture and distribution of special solid carbide end mills, drills, reamers, boring tools and rotary files.

V V V

An Electronic Components Dept. has been formed by the Rex Corp. to produce components for electronic computers. Rex was acquired in March, 1958 by American Enka Corp.

new companies

A corporation called Bedford Sales Co., Inc., with offices in Boston and New York City, was formed recently to handle sales and application of equipment produced by Telecontrol Div. of Hancock Industries in New England, eastern New York, New Jersey and eastern Pennsylvania.

V V V

Elion Instruments, Inc. was formed in Bristol, Pa. to specialize in research, development and production of ultrasonic transducers, electron spin resonance equipment and X-ray microanalyzers. It also will conduct consulting and development services in certain areas.

V V V

King Graphite Products, Inc. has started operations at 21949 S. Telegraph Rd. in Trenton, Mich. producing graphite lubricating products for heavy industry and transportation. Principal products of the new company include a lubrication fortifier called KGP which is a synthetic colloidal graphite of particle size permanently suspended in a neutral oil carrier for use in conjunction with lubricants, and blended in other carriers for specific purposes.

expansions

The Heiland Div. of Minneapolis-Honeywell Regulator Co. has expanded its Denver facilities for the second time in two years. The recently completed program, which contains more than 70,000 sq ft of engineering, production and administrative facilities, will be used for wiring and testing of the division's industrial recording instruments.

V V V

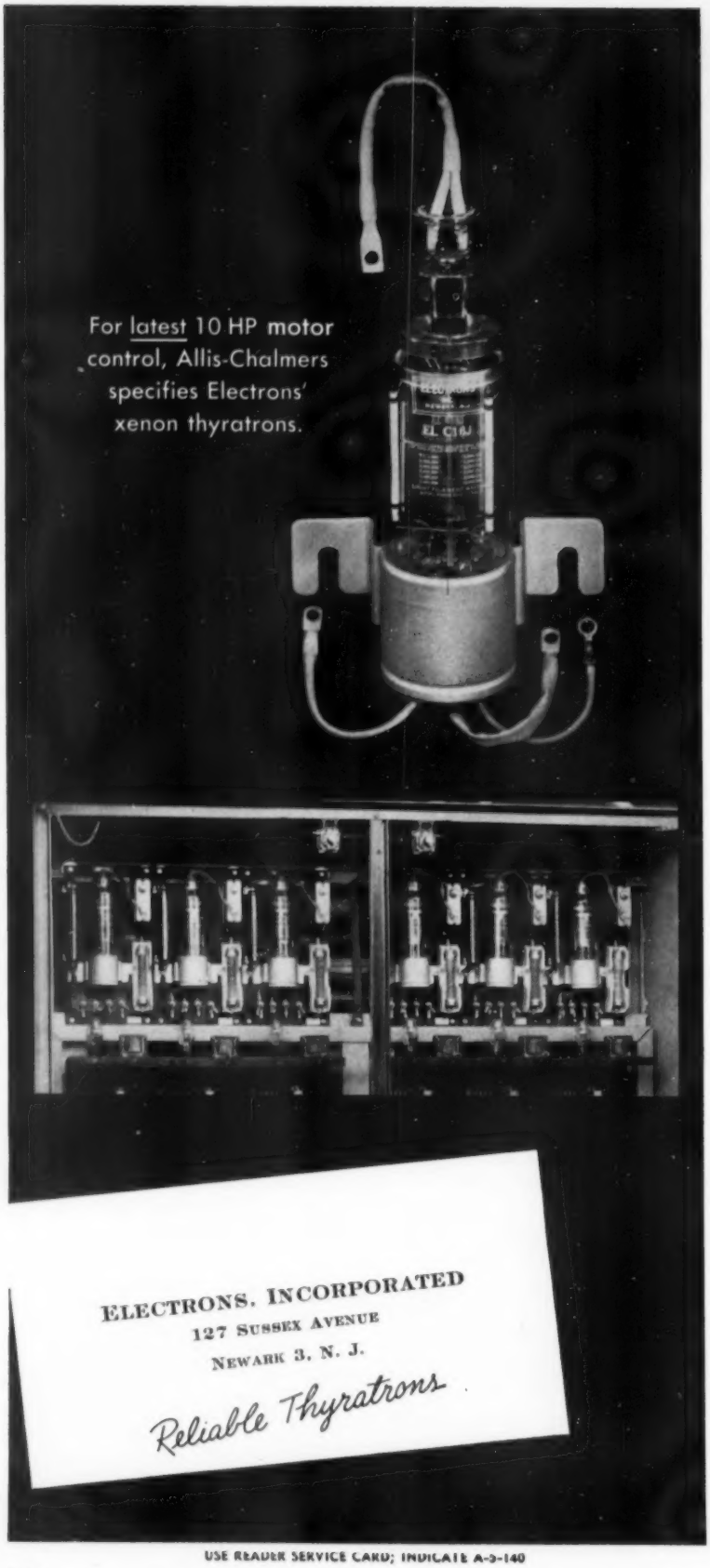
A new building now houses the Chicago branch of Vickers Inc., division of Sperry Rand Corp. The structure, at 350 N. York Rd. in Bensenville, Ill., provides increased facilities for warehouse stocks and repair and field service operations.

association news

A group of companies that produce, melt and process zirconium have formed the Zirconium Association. Increased importance of and interest in the use of the metal brought about the association for the purpose of expanding uses of zirconium and to establish a focal point from which greater and close cooperation could be developed between industry and governmental agencies. Headquarters for the organization is at 2130 Keith Bldg., Cleveland.

V V V

An English translation of one of Russia's leading technical journals is being published monthly by Britain's Production Engineering Research Association, which is supported by the British Department of Scientific and Industrial Research. The cover-to-cover translation, which appears under the title of *Machines and Tooling*, is calculated to enable engineers to study personally the developments taking place within Russia in production techniques and equipment.


For latest 10 HP motor control, Allis-Chalmers specifies Electrons' xenon thyratrons.
ELECTRONS, INCORPORATED
127 SUSSEX AVENUE
NEWARK 3, N. J.
Reliable Thyratrons
USE READER SERVICE CARD; INDICATE A-9-140

The Investment Casting Institute recently set up a cooperative technical research program to provide improved services to its membership. Through the program, each member of the organization will contribute one research study; in return, it will receive a completed study from each of the other members. As a result, each member will be able to assemble a library of authoritative research information on investment casting technology.

acquisitions

According to recent announcement, Bay State Tap and Die Co. has become a subsidiary of The Cleveland Twist Drill Co. Operations of Bay State are continuing in Mansfield, Mass. Louis A. Lincoln, who has served as president for the past 22 years, will remain in that capacity. Mr. Lincoln is a member of ASTE's Boston chapter.

V V V

Combustion Engineering, Inc. recently acquired General Nuclear Engineering Corp., a nuclear engineering and consulting firm. Dr. Zinn, who was head of the acquired company, was elected a vice-president of Combustion.

V V V

Corporate name of The Turner Brass Works has been changed to Turner Corp. Reason given for the change is the company's product diversification and marketing modernization program which obsoletes the original name used since E. F. Turner established the firm in Chicago in 1871.

V V V

Acquisition of the assets of Redmond Electric Motors of Canada Ltd. by Controls Co. of America (Canada) Ltd. have been approved by the boards of directors of both companies. The two companies are subsidiaries of Controls Co. of America.

V V V

Assets of Vacuum Tube Products Co., Inc. were purchased by Hughes Aircraft Co. Now part of the Hughes Products Group, the company's commercial division, Vacuum Tube will continue to market and produce its lines of products and equipment in existing plants under the same management. There are no immediate plans to alter the company's operation.

V V V

Bear Mfg. Co. has purchased the Balance Engineering Co. of Chicago. Concurrently, Bear announced five new models to extend the range of production line balancing units to handle most all requirements from one ounce to 400 lb of bodies up to 36 in. swing.

who's meeting and where

May 4-5. American Society of Mechanical Engineers. Maintenance and plant engineering division conference, Edgewater Beach Hotel, Chicago, Ill. Society headquarters, 29 W. 39th St., New York 18, N.Y., can supply details.

May 4-8. National Industrial Production Show of Canada, Exhibition Park, Toronto. Further information is available from show management office, 19 Melinda St., Toronto, Ontario.

May 6. American Society of Tool Engineers. Seminar on optical tooling and gaging in manufacturing, Chase-Park Plaza Hotel, St. Louis, Mo. All details are available from Society headquarters, 10700 Puritan Ave., Detroit 38, Mich.

May 7. Society of Plastics Engineers, Inc., Pittsburg Section. Regional technical conference on plastics and the metal industry, Penn-Sheraton Hotel, Pittsburgh, Pa. Write to John E. Parks, chairman, 35 Woodland Dr., Pittsburgh 28, Pa. for details.

May 7. Armour Research Foundation of Illinois Institute of Technology and Chicago section of Electrochemical Society. Symposium on corrosion inhibition, Illinois Tech campus, Chicago. Direct inquiries to M. J. Jans, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

May 7-8. University of Wisconsin, University Extension Div. Engineering institute on adhesives and fasteners. Complete information may be had from Dept. of Engineering, University Extension Div., University of Wisconsin, Madison 6, Wis.

May 11-13. Instrument Society of America. National power instrumentation symposium, Kansas City, Mo. For program information, contact H. H. Johnson, Consolidated Edison Co. of New York, Rm. 1515-S, 4 Irving Pl., New York 3, N.Y.

May 11-13. Conference on automatic techniques, jointly sponsored by

SAVE UP TO 90%
on DIE COSTS and LEAD TIME
WITH LEMPCO'S NEW
BALL BEARING MASTER DIE SETS

NOW IN STOCK IN SIZES FROM 9" x 6" TO 72" x 48"

...A "NATURAL" FOR EVERY USER OF DIES!

Save time . . . and money . . . with Lempco Ball Bearing Master Die Sets—with *Complete Interchangeability.* All parts are interchangeable with like parts in every other Lempco Master Set, anywhere. Quick set-up and easy changeover. Use one Master Die Set for *several* dies. Save on die sets . . . save on storage and handling. The Lempco Master Die Set properly mounts dies for processing all materials. Find out about these time-savers; the country's largest manufacturers are using them.

WRITE TODAY FOR YOUR COPY OF OUR MASTER DIE SET BROCHURE.

LEMPCO INDUSTRIAL, INC.
DUNHAM RD. BEDFORD, OHIO

WHERE QUALITY CONTROLS

USE READER SERVICE CARD; INDICATE A-5-141

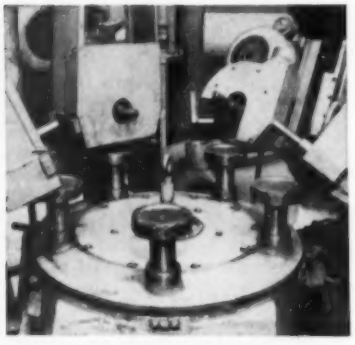
OSBORN

BEFORE BRUSHING—Clutch back-up plate has sharp edges . . . carries fine chips and burrs inside teeth.

AFTER BRUSHING—Edges and surface junctures are uniformly precision blended. Chips and burrs are thoroughly removed to help assure troublefree performance.

Auto maker races to a perfect finish

. . . cleans, blends 450 parts-per-hour with OSBORN Power Brushing



4 POWER BRUSHING HEADS plus a 6-station index table setup produce a quality finish for automotive clutch parts. Osborn Monitor® Brushes — working at 1750 rpm — automatically deburr and blend 450 parts-per-hour in this low-cost operation.

THESE clutch back-up plates—product of a leading auto manufacturer—are quality finished at high production rates with versatile, low-cost Osborn Power Brushing.

The job requires blending sharp edges and surface junctures of the intricately shaped parts . . . plus thoroughly removing fine metal chips and burrs that could later cause trouble in the clutch assembly. *This Osborn rotary power brushing setup does the entire blending and deburring job rapidly, uniformly, economically. Rate: 450 parts-per-hour.*

Low-cost precision finishing like this can be applied to many types of products you build today. An **O**sborn **B**rushing **A**nalysis — made in your plant at no cost or obligation—can pinpoint where *you* can speed production . . . improve quality . . . cut costs with modern power brushing methods. Write or wire us for details. *The Osborn Manufacturing Company, Dept. K-55, Cleveland 14, Ohio.*

Osborn Brushes

BRUSHING MACHINES • BRUSHING METHODS
POWER, PAINT AND MAINTENANCE BRUSHES • FOUNDRY PRODUCTION MACHINERY
USE READER SERVICE CARD; INDICATE A-5-142

American Institute of Engineering Education, American Society of Mechanical Engineers and Institute of Radio Engineers. Pick Congress Hotel, Chicago. Information may be obtained from ASME office, 29 W. 39th St., New York 18, N.Y.

May 12-14. AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Detroit, section. Production engineering conference, Statler-Hilton Hotel, Detroit, Mich. For more information, contact Henry J. Langlois, c/o American-Standard Industrial Div., 8111 Tireman Ave., Detroit 32, Mich.

May 13-14. PORCELAIN ENAMEL INSTITUTE. Annual meeting, The Greenbrier, White Sulphur Springs, W. Va. Contact institute office, Associations Bldg., 1145 Nineteenth St., N.W., Washington, D.C. for details.

May 14-17. AMERICAN INSTITUTE OF INDUSTRIAL ENGINEERS, INC. 10th annual national conference and convention, Atlanta Biltmore, Atlanta, Ga. Get more data from the institute, P.O. Box 5255, Sta. E., Atlanta 7, Ga.

May 18-20. INSTRUMENT SOCIETY OF AMERICA. Fifth national symposium on instrumental methods of analysis, Shamrock-Hilton, Houston, Texas. Write to H. S. Kindler, director technical and educational services, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

May 20-22. SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS. Spring Meeting, Sheraton-Park Hotel, Washington, D.C. For more information, write society office, P. O. Box 168, Cambridge 39, Mass.

May 25-27. AMERICAN SOCIETY FOR QUALITY CONTROL. Annual convention and all-industry production and quality control exposition, Hotel Sheraton and Public Hall. Cleveland, Ohio. Details are available from society office, 161 W. Wisconsin Ave., Milwaukee 3, Wis.

May 25-28. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Design engineering conference, Philadelphia Convention Hall, Philadelphia, Pa. Get pertinent data from society headquarters, 29 W. 39th St., New York 18, N.Y.

May 25-28. DESIGN ENGINEERING SHOW AND CONFERENCE sponsored by machine design division of American Society of Mechanical Engineers, Convention Hall, Philadelphia, Pa. Complete information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

June 1-12. PURDUE UNIVERSITY. Indus-

They're tough, they're versatile

. . . and amazingly low in cost!

ACE

STUB DRILLS

The short, heavy duty flutes of Ace Stub Drills are ground into top quality pre-hardened high speed steel to give you keener cutting lips, extra strength, longer drill life. Ideal for close-to-work screw machine operations and portable drilling. And they're now stocked in 140 standard sizes that cost approximately 20% less than equivalent jobber length drills!

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL

ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

INDICATE A-5-143-1

trial Engineering Institute covering eight short courses relating to manufacturing. For more information, write to Prof. J. A. Ritchey, Dept. of Industrial Engineering, Purdue University, West Lafayette, Ind.

June 9-12. THE MATERIAL HANDLING INSTITUTE, INC. 1959 Exposition, Cleveland Public Auditorium. Technical sessions sponsored by American Material Handling Society, Inc. with cooperative endorsement of the Society for Advancement of Management and the Material Handling Div. of the American Society of Mechanical Engineers. For details contact Material Handling Institute office, Suite 759, One Gateway Center, Pittsburgh 22, Pa.

June 9-19. PURDUE UNIVERSITY. Short course in quality control by statistical methods, university campus. Get more facts from The Statistical and Computing Laboratory, Purdue University, West Lafayette, Ind.

June 14-18. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Semiannual meeting, Chase-Park Plaza Hotels, St. Louis, Mo. For further information write to ASME Meeting Dept., 29 W. 39th St., New York 18, N.Y.

June 14-19. SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Society office, 485 Lexington Ave., New York 17, N. Y., can supply more information.

June 15-24. UNIVERSITY OF MICHIGAN. Intensive course for practicing engineers on automatic controls, U of M campus, Ann Arbor, Mich. Get details from Fred Moncrieff, College of Engineering, University of Michigan, Ann Arbor, Mich.

June 16-19. CORNELL UNIVERSITY. Eight industrial engineering seminars, university campus, Ithaca, N. Y. Address inquiries for more information to J. W. Gavett, Seminars Coordinator, Upson Hall, Cornell University, Ithaca, N. Y.

June 18-20. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Applied mechanics division conference, Virginia Polytechnic Institute, Blacksburg, Va. Obtain other details from society meetings Dept., 29 W. 39th St., New York 18, N. Y.

June 19. SOCIETY OF PLASTICS ENGINEERS, INC., Detroit section. Technical meeting on plastics in the automotive industry. For information write to Chm. John Donalds, The Dow Chemical Co., 450 Fisher Bldg., Detroit 2, Mich.

INDUSTRIAL DISTRIBUTORS SERVING INDUSTRY ECONOMICALLY THE RIGHT HAND OF PRODUCTION

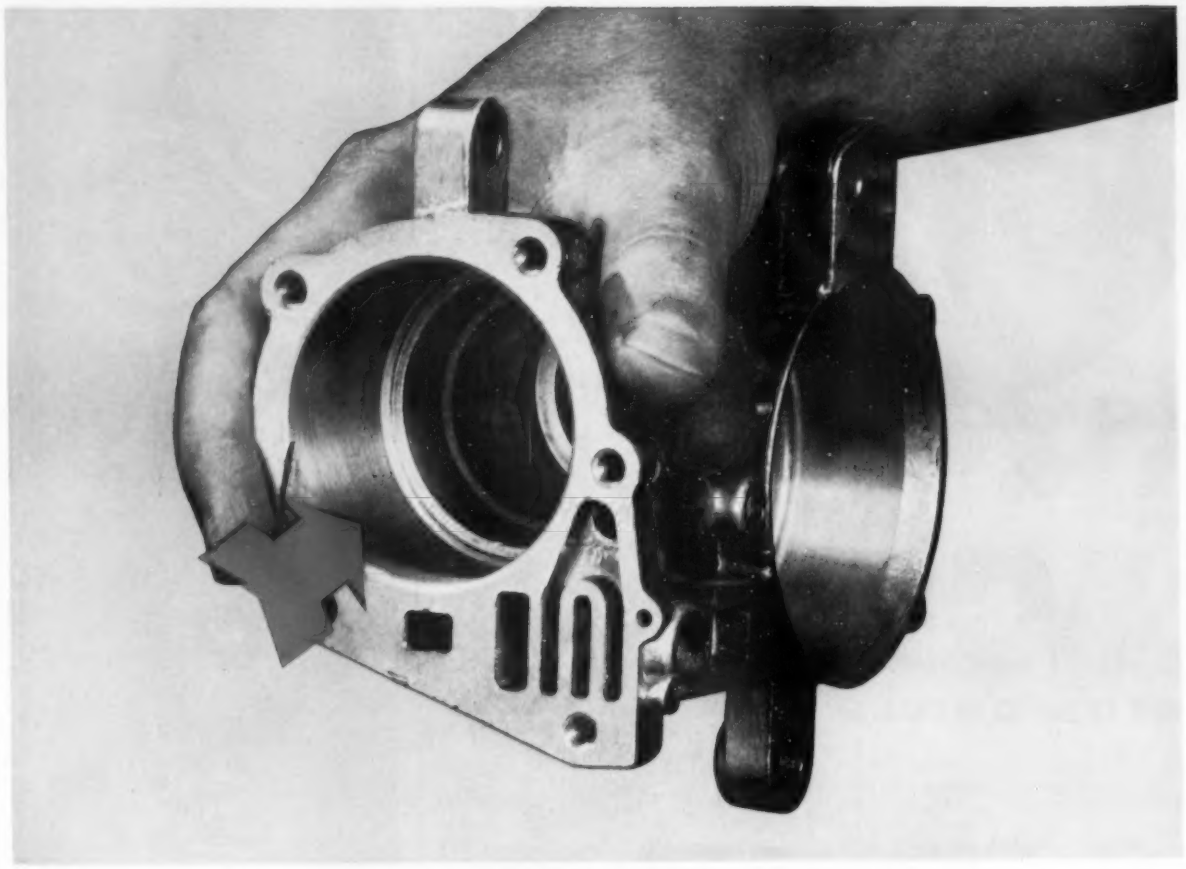
SEE YOUR CAPEWELL DISTRIBUTOR

for
hand hack saws
power hack saws
hole saws
band saws
hammers
ground flat stock
and for quick
dependable service
on all your
industrial needs

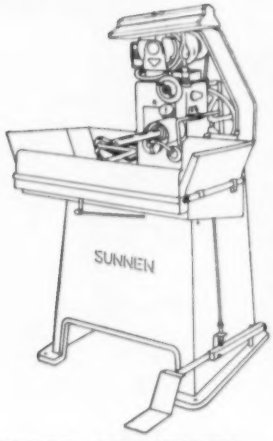
CAPEWELL

THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

INDICATE A-5-143-2



HOW WOULD YOU PRECISION-FINISH THIS BLIND HOLE?



This die-cast aluminum valve part called for a geometrically perfect round hole . . . with maximum finish of 16 micro-inches, neither obtainable on precision boring equipment.

The simple solution was to follow the boring operation with Sunnen Honing . . . leaving just enough stock to correct errors and produce the required finish.

Sunnen Honing maintains previous alignment, guarantees tolerance to .0001" . . . and assures consistent precision-finish from part to part. The part stabilizes itself on the honing tool and requires no chucking or fixtures. Thus, the hole can be gaged at any time until the specified size is reached. Result is geometric accuracy of roundness and straightness. No scrap loss!

Average Sunnen Honing Machine installation with tooling is about $1,000.

RANGE OF SUNNEN HONING TOOLS

- **For Machine Applications**
  Standard from stock, .100" through 2.625" dia.
  Built to order, through 4½" dia.
- **For Portable Applications**
  from 1¾" through 20½" dia.

YOURS FOR THE ASKING

BULLETIN XSP-5075
99 Case histories with honing production rates

SUNNEN® PRODUCTS COMPANY
HONING

7927-E Manchester Ave. • St. Louis 17, Mo.
Canadian Factory: Chatham, Ontario

8787

Trade Literature

for free booklets and catalogs—use request card, page 135

Counterbores and Countersinks

Well illustrated, 8-page Catalog No. 59 describes line of counterbores and countersinks to be used with a line of standard extensions to provide extra length; gives dimensions and specifications. Bicknell-Thomas Co., Greenfield, Mass. **L-5-1**

Standardization for Automation

Pocket-size 32-page booklet, "Better Products for Automation Through Standardization," prepared from lectures and discussions conducted at engineering conferences and seminars by company president; outlines adaptability of standardized precision gears and allied components to variety of design requirements; detailed material illustrated with photos, engineering drawings and data tables. PIC Design Corp., 477 Atlantic Ave., East Rockaway, N. Y. **L-5-2**

Automatic Assembly

Extensively illustrated Bulletin No. 601 explains various aspects of automatic assembly which lead to cost justification; covers increased production, tooling, versatility etc. Ferguson Machine Corp., 7818 Maplewood Industrial Ct., St. Louis 17, Mo. **L-5-3**

Air Valves

Twelve-page "Valve Finder" catalog offers informative discussion of air valves and their selection and condensed catalog listings of all Hannifin valves; includes section explaining valve terms and principles used in air control valve industry; presents three-step outline covering valve types, means of actuation, operating principles to simplify choosing proper valve for specific application. Hannifin Co., Dept. 120, Des Plaines, Ill. **L-5-4**

Lathes

Complete information and specifications for Wade No. 94 electric clutch hand turret lathes are presented in well illustrated 12-page brochure emphasizing important features of design and construction and their advantages. Pratt & Whitney Co., Inc., Charter Oak Blvd., West Hartford 1, Conn. **L-5-5**

Grinding Wheels

Bright wall chart presents 10 Do's and 10 Don'ts of grinding wheel safety in crisp, easy-to-read, easy-to-remember copy. Advertising Distribution Section, Bldg. W-5, The Carborundum Co., Walmore Rd., Niagara Falls, N.Y. **L-5-6**

Hole Drilling

Facilities for drilling difficult holes in production pieces of all types of materials and hardnesses described and pictured in well illustrated folder. 20th Century Machine Co., 6070 E. 18 Mile Rd., Utica, Mich. **L-5-7**

Eclipse
CUTTING TOOLS
are
"Engineered for You!"
For almost half a century ECLIPSE has engineered and produced quality cutting tools. These years of leadership in the field guarantee the superiority and dependability of all ECLIPSE products. For longer tool life, finer finishes and better all-around performance, look to the symbol of perfection.
• H.S.S. CUTTERS • T.C.T. CUTTERS • CORE DRILLS
• BACK SPOTFACERS • MULTI-DIAMETER CUTTERS
• INSERTED BLADE CUTTERS • PORT CONTOUR CUTTERS
WRITE FOR CATALOG 51
ECLIPSE COUNTERBORE COMPANY
1600 BONNER AVE., DETROIT 20, MICHIGAN

USE READER SERVICE CARD; INDICATE A-5-145

Tungsten Carbides

Complete line of tungsten carbide tools, tool tips, dies, wear parts and Dex-A-Tools described and illustrated in 32-page Catalog No. 359. Adamas Carbide Corp., Kenilworth, N.J. **L-5-8**

Buffing and Polishing

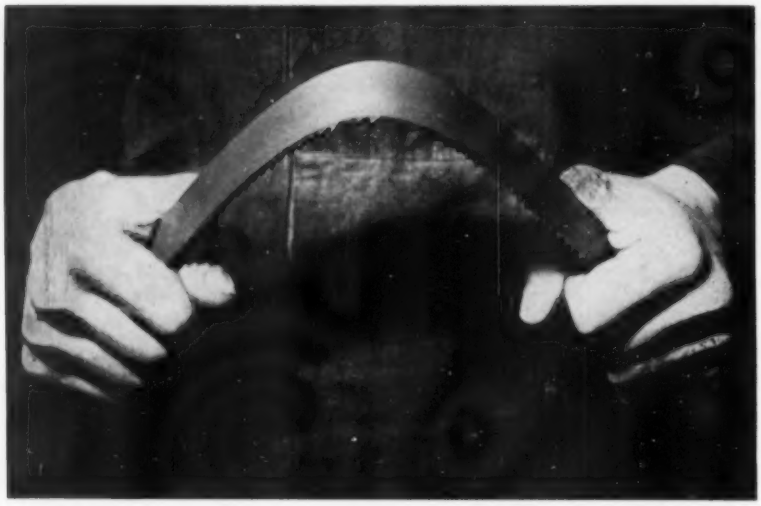
More than 150 compounds for buffing and polishing and their applications described in 20-page Bulletin No. Co-104; includes those for chromium, steel and stainless steel, hard rubber and plastic; also discusses and illustrates Liquimatic application equipment and compounds and tripolis and lime for nonferrous metals. J. C. Miller Div., Hanson-Van Winkle-Munning Co., Grand Rapids, Mich. **L-5-9**

Disk Grinding

Illustrated, 8-page brochure presents detailed data on DH4 double horizontal spindle disk grinder; covers design, construction, special features and advantages of equipment; includes mechanical drawings and specification data. Besly-Welles Corp., South Beloit, Ill. **L-5-10**

Drawing and Layout Equipment

Six-page folder describes in detail the important design features and advantages of coordinate drawing machines for increased precision and speed in drafting or optical projector chart-gage layout; well illustrated. Optical Gaging Products, Inc., 26 Forbes St., Rochester 11, N.Y. **L-5-11**



THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge.

With a MARVEL Blade, you can cut any material—from the free machining steels to the toughest alloys . . . fast, accurately and economically. You can tension a MARVEL Blade from 200% to 300% tauter than any ordinary blade, permitting much higher speeds and heavier feeds without deflection or breakage.

Like all good things, attempted copies of the MARVEL Blade have been numerous, but its performance has been *unequalled* by any of the imitators. Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

Write for latest cutting tool Bulletin and the name of your nearest MARVEL *Distributor.*

FB-1020

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 W. Bloomingdale Ave., CHICAGO 39, U.S.A.

USE READER SERVICE CARD; INDICATE A-5-146

Coated Abrasives

Vol. 1, No. 2 of "The Abrasives' Workshop" contains informative articles on qualities and uses of coated abrasives, including case-history stories; illustrated. Coated Abrasives Div. and Curtis Machine Div., The Carborundum Co., Niagara Falls, N.Y. **L-5-12**

Electric Production Tools

Line of solenoid operated impact hammers, punches, stakers and Geneva action indexing tables presented in 12-page catalog which includes section on custom engineering automatic production machinery; illustrated. Black & Webster, Inc., 445 Watertown St., Newton 58, Mass. **L-5-13**

Plating

Eight-page booklet, "Linde 'Plasmarc' Plating," describes plasma arc technique for applying coatings and fabricating shapes to metals in the high temperature range; explains application, uses, qualities and characteristics. New Products Dept., Linde Co., Div. of Union Carbide Corp., 30 E. 42nd St., New York 17, N.Y. **L-5-14**

Strain Gages

Twenty-four page Specification and Price List 4310 on SR-4® strain gages, instruments and accessories, explains their uses, advantages, characteristics and describes their construction; drawings and charts help clarify text. Baldwin-Lima-Hamilton, Electronics & Instrumentation Div., Waltham 54, Mass. **L-5-14**

Cylinders

Condensed, illustrated 16-page brochure covers line of standard and special hydraulic and pneumatic cylinders and related products; offers dimensions, specifications, information on selection and application for each type unit; indexed for easier reference. Petch Mfg. Co., 463 York, Detroit 2, Mich. **L-5-16**

Fluid Power Components

Hydraulic, pneumatic and vacuum catalog contains flow charts and helpful information for engineering and maintenance men; incorporates complete data on company's O-ring seal tube, flare and pipe fittings, tube benders etc. Lenz Co., Box 1044, Dayton 1, Ohio. **L-5-17**

Automatic Machining

Well illustrated with photos and drawings, 16-page brochure, "Production Tips," shows 14 different setups to indicate versatility of Model 0 Bore-Matic for automatic machining simultaneously or in sequence. The Heald Machine Co., 7 New Bond St., Worcester 6, Mass. **L-5-18**

Carbide Cutting Tools

Designed to help machine operators, tool layout and tool maintenance men in selection, application and maintenance of Kennametal cemented carbide cutting tools, a new 64-page edition of pocket-sized "Kennametal Tool Manual No. 7" includes revision of grade and cutting speed table to incorporate harder carbide grades and revised recommendations for machining various materials; tool wear analysis and grade check chart included plus problem-and-solution section which has been enlarged to cover throw-away insert tooling. Kennametal, Inc., Latrobe, Pa. **L-5-19**

Automatic Production

Illustrated by photos, drawings and charts, 24-page manual, "How to Evaluate Milwaukee-Matic," provides prospective buyer with information of how to evaluate a new tool and its concept versus present conventional machines and methods; explains how to estimate production time on this equipment, how to estimate machine cycle time, and offers general considerations for estimating. Request only on company letterhead direct from Kearney & Trecker Corp., Milwaukee 14, Wis.

Tape Controlled Drilling, Tapping, Boring

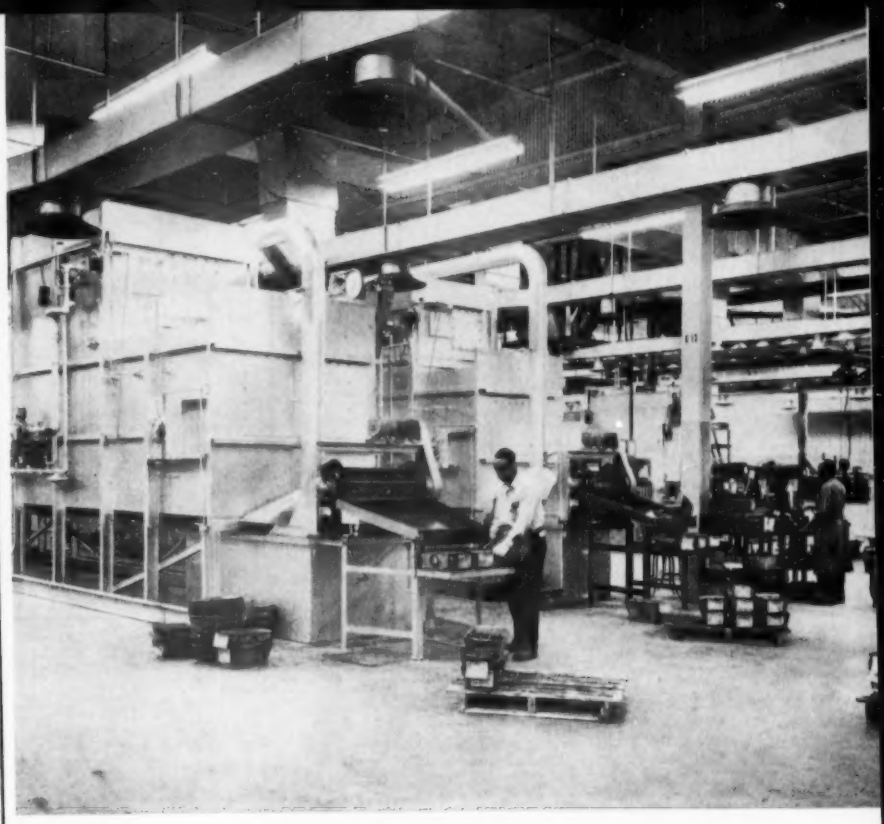
How to program a part, prepare the tape and operate the machine are explained in detail in extensively illustrated 12-page bulletin on G-E's tape controlled Burgmaster 6 and 8 spindle turret drilling, tapping and boring machines; offers details on cost reducing machine features and other advantages. M. R. Crossman Co., 546 N. Hollywood Way, Burbank, Calif. **L-5-20**

Strain Gages

Characteristics of resistance strain gages made by eight U.S. manufacturers are compared in 24-page article "How to Select a Strain Gage" reprinted from *Strain Gage Readings;* specifies selection criteria for various strain gage properties under different operating conditions. Stein Engineering Services, 5602 E. Monte Rosa, Phoenix, Ariz. **L-5-6**

V-Belt Drives

Complete drive design information on Super HC V-belt drive included in 32-page Catalog DH-900; drive tables show how to handle both stock and nonstock drives; provides information to help determine service life of drive being designed, and describes advantageous features of the belts and sheaves. The Gates Rubber Co., Denver, Colo. **L-5-22**



New heat treating equipment produces better fasteners at

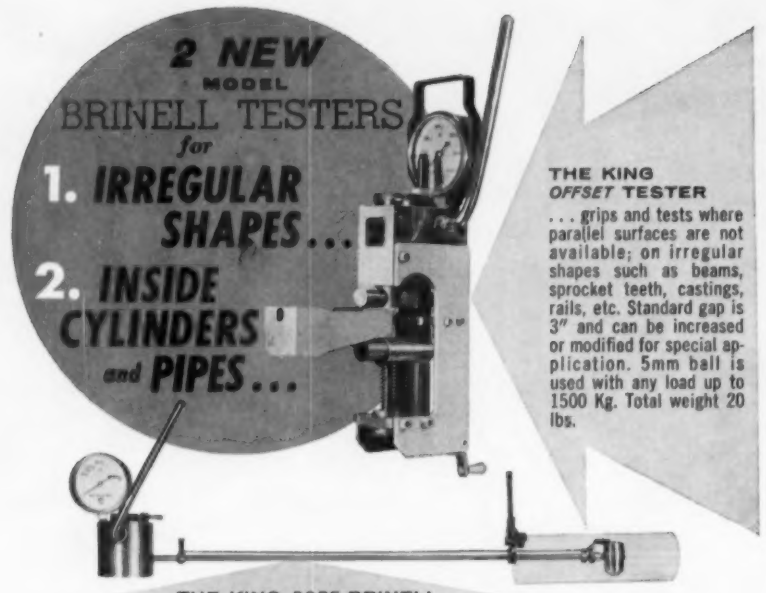
ALLEN

These new, specially designed Holcroft heat treating units harden, quench, wash, and temper in a continuous operation. Automatic devices regulate and record processing data for accurate, close control of this all-important manufacturing function.

Throughout Allen's great new plant, new facilities like these assure constantly higher quality in hex socket screws and related products. Today, more than ever, ALLEN is the "buy word" for socket screws, as well as keys, dowel pins, and pipe plugs.

Allen Flat Head Cap Screws, in countersunk tapped holes, give you absolutely flush surfaces. Where you can't countersink—fastening thin metal parts like covers, access panels, or guards, for example—Allen Button Head Cap Screws will give you the smooth, streamlined effect you want. Class 3A fit. Leader points, of course. Available from stock in all popular sizes. Ask your Industrial Distributor for samples and full information. Or write directly to The Allen Manufacturing Company, Hartford 1, Conn.

ALLEN HEX-SOCKET SCREWS HEAD



THE KING *OFFSET* TESTER

. . . grips and tests where parallel surfaces are not available; on irregular shapes such as beams, sprocket teeth, castings, rails, etc. Standard gap is 3" and can be increased or modified for special application. 5mm ball is used with any load up to 1500 Kg. Total weight 20 lbs.

THE KING *BORE* BRINELL

. . . employs a new King Test Head with extension holding indenting ball that can be inserted into cylindrical openings 2" to 7" in diameter, and to any desired depth. Load can be varied from 125 Kg. to 1000 Kg. Total weight 15 lbs.

Write for complete literature and prices to Dept. TE-5

KING TESTER CORPORATION 440 N. 13th St., Phila. 23, Pa.

Known the world over for accuracy and dependability

USE READER SERVICE CARD; INDICATE A-5-148-1

STYLE AND SIZES FOR ALL MACHINES ON WHICH THREADS ARE CUT

On Brown and Sharpe, and other automatics

INSERT CHASERS SAVE UP TO 33%

Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For approximately $50 you get a dozen sets of ¾—16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specfications, with a minimum of downtime. FREE: "Unified and American Screw Thread Digest".

THE EASTERN MACHINE SCREW CORPORATION 27-47 Barclay St., New Haven, Conn.

USE READER SERVICE CARD; INDICATE A-5-148-2

good READING

HANDBOOK OF INDUSTRIAL ENGINEERING AND MANAGEMENT—*Edited by W. Grant Ireson and Eugene L. Grant. Published by Prentice-Hall, Inc., Inglewood Cliffs, N. J. Price $16. 1220 pages.*

This handbook will be useful to other people besides practicing industrial engineers and students of industrial engineering and management. For instance, the book will be valuable to persons who have been trained in other engineering fields, but who are now engaged in management activities.

In contrast to the situation in some of the older engineering fields, topics included in an industrial engineering handbook are not clearly defined by custom. Certain traditional engineering subjects such as motion and time study, production control, job evaluation, plant layout and materials handling and tool engineering, for example, obviously call for coverage. Other closely related subjects that have been included are: engineering economy, budgeting. standardization, safety engineering, industrial hygiene and quality control.

Also included in the handbook is a discussion of the trade union outlook on industrial engineering and of unusual interest is the treatment of industrial operations research by A. W. Swan of Coventry, England.

Systematic references to other authoritative articles or books make this an up-to-date guide to the literature as well as a thoroughly comprehensive self-contained guide to the field.

PROFITING FROM INDUSTRIAL STANDARDIZATION—*By Benjamin Melnitsky. Published by Conover-Mast Publications, Inc., 205 E. 42nd St., New York 17, N. Y. Price $5. 400 pages.*

For many years standardization was exclusively in the province of the engineering profession. Today it is recognized that the same principles and

techniques can be applied with equally beneficial results in virtually every phase of industry and business. These include product design, methods engineering, production management, packaging, shipping, purchasing, inventory and storekeeping.

With this in mind, the volume was written to help achieve three main objectives:

1. To give an over-all, but concise view of standardization as it exists in industry today.
2. To show exactly how profits are obtained from standardization.
3. To show how to distribute and how to use industrial standards in a company.

In large measure the "how to" element is derived from a study of the applications of standardization in industry.

Many individuals in American industry shared their standardization experiences and offered their advice and counsel. Every chapter is supplemented with actual case histories which enable the reader to share the experiences and the advice of these prominent industrial management men.

MACHINERY'S MATHEMATICAL TABLES—*Edited by Holbrook L. Horton. Published by The Industrial Press, 93 Worth St., New York 13, N. Y. Price $3.75. 258 pages.*

A selection of the most commonly used tables of mathematical information have been combined into a pocket sized edition. These tabulated data and formulas should be useful to anyone needing to make calculations.

THE ENCYCLOPEDIA OF CHEMISTRY *(Supplement)—By George L. Clard, et. al. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $10. 322 pages.*

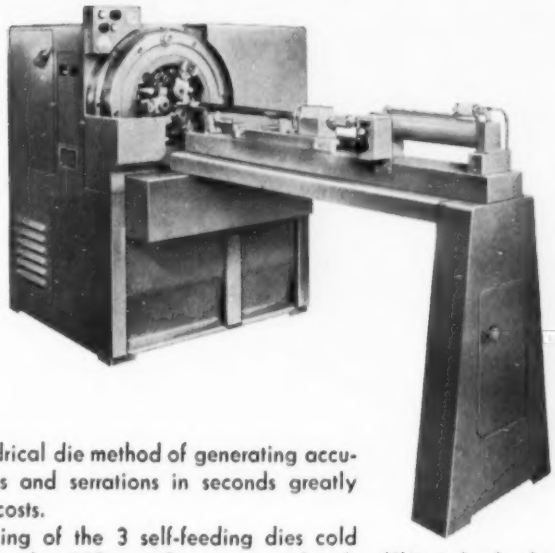
This supplement adds over 200 articles to those contained in the original volume of the *Encyclopedia of Chemistry*. Discussion of current topics has been included to round out the parent book. Together, they comprise one of the most up-to-date and authoritative chemical reference works.

BIBLIOGRAPHY NO. 13 ON SHELL MOLDING—*Compiled by the Engineering Societies Library, 29 W. 39th St., New York 18, N. Y. Price $2. 28 pages.*

A selected list of over 200 annotated references covering all aspects of the subject, including theory, technology, design, production practice in ferrous and nonferrous foundries, materials, testing methods, equipment, applications, and costs is included in this bibliography.

Reed 3-Cylindrical Die Machine

. . . produces splines faster with greater accuracy



It's Fast ...

It's Accurate..

It's a Money Maker ...

The Reed 3 cylindrical die method of generating accurate involute splines and serrations in seconds greatly reduces production costs.

The precise tracking of the 3 self-feeding dies cold forms the teeth with either 30° or 45° pressure angles. It gives greater tooth strength and better surface finish. The machine may be automated or equipped with a semi-automatic loading fixture.

Write today for detailed information.

If it can be rolled—write Reed.

REED SM-175

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

HOLDEN, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

USE READER SERVICE CARD; INDICATE A-S-149

Now...B & S Offers 20% Savings on 80% of End Mill Applications!

Thriftmill
Brings "Throw Away" Tool Concept to End Mill Operations!

Why is the initial price of the NEW B & S Thriftmill 15 to 20% less than conventional end mills at a time when most other metal-working costs are rising?

This is a new exclusive design, a product of B & S progressive engineering and manufacturing techniques. The Thriftmill can be produced faster, more efficiently and therefore costs less.

Demand for the new Thriftmill is so phenomenal—large volume production lowers manufacturing and distribution costs.

Shop tested on profiling, slotting, peripheral milling and many other general end milling operations, the Thriftmill excels in over 80% of production applications. The new Thriftmill may mean new end milling economy and efficiency for you.

Ask your Distributor about the New B & S Thriftmill today! Send for new CONDENSALOG —easy to use specifications and prices on over 3300 "standard" cutters and end mills to: *Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.*

FOR THAT EXTRA EDGE IN PRODUCTION

Brown & Sharpe

CUTTING TOOL DIVISION

HIGH SPEED STEEL CUTTERS
NELCO CARBIDE TOOLS
END MILLS

PROGRESS IN PRECISION FOR OVER 125 YEARS

USE READER SERVICE CARD; INDICATE A-3-150

TOOL ENGINEERING in Europe

By M. Kronenberg
Consulting Engineer
Cincinnati 6, Ohio

Turning Titanium

Sintered carbide tips of the cast-iron grades (German standards H1, H2, and G1) are superior to diamond tools for machining pure titanium, according to a report by P. H. Brammertz published in *Industrie Anzeiger*, Vol. 80, 1958, p. 1345-1348, under the title: "Feindrehen von Reintitan."

Cutting tests showed that diamond tools give good surface finishes but break down under pressures or high temperatures developed in the machining of pure titanium, while carbide tools give satisfactory results.

Cost of Accuracy

Another article by P. H. Brammertz, with H. Schuler, deals with the cost of accuracy in finish turning and grinding. It is published in *Industrie Anzeiger*, Vol. 80 (97), p. 1471-1480, under the title: "Die Werkstueck-Guete beim Feindrehen und Feinschleifen und ihr Einfluss auf die Fertigungskosten."

The authors ran tests on steel, measuring surface finishes, dimensional accuracy and workpiece shapes in comparison with specified standards. Conditions of chip formation, chip size and tool geometry were taken into consideration. Sintered carbide tools were used in most cases and the relationship between machine tool and workpiece accuracy was carefully investigated, particularly in the case of fine turning operations. It was found that cutting force and cutting temperatures have the greatest effects on the geometrical accuracy of the workpiece.

Machine Tool Monitor

An article by D. V. Blake and L. A. Sayce, published in the *Transactions of the British Society for Instrument Technology*, Vol. 10 (4), 1958, p. 190-196, deals with the accuracy of the mo-

tions of the saddle of a machine tool under operating conditions. Moiré fringes derived from a pair of diffraction gratings were used as a means of establishing an accurate reference. The application of the method for screw-cutting lathes requiring high precision, with up to 5000 threads per inch, is discussed. Instrument errors are also discussed. These do not exceed a few microinches. When using the instrument on an engine lathe, the diffraction gratings can be replaced by engraver's ruled screens. Machine motions can be controlled by feedback.

High-Speed Dental Drilling

Although developments in dentistry do not directly affect tool engineering, it is of interest to tool engineers to look into neighboring fields where drilling is applied.

C. H. Fischer has studied the problems involved in "painless" high-speed dental drilling and has published his results in an article in *Umschau*, Vol. 58 (20), 1958, p. 626-627. He concludes that the substantial reduction in vibration made possible by ultrahigh-speed drilling is the cause for the reduction in pain when drilling teeth. The speed level reached is, however, not yet entirely satisfactory; hence the article is: "Schmerzloses Bohren mit hohen Touren?"

The very high-speed drills cannot as yet be mass-produced in Germany. Ranges up to about 40,000 rpm are possible, while 300,000 rpm in a turbine-propelled drill are required. It is, however, interesting to note that the vibration is less in a high-rpm drill than in a conventional drill.

Cast High-Speed Tools

Under sponsorship of the German Association of mining engineers (Verein Deutscher Eisenhutten Leute) an investigation of the productivity of high-speed steel tools made by a casting process has been completed. The method is described in an article published by K. A. Krekeler in *Stahl und Eisen*, Vol. 78 (22), 1958, p. 1575-1585, under the title: "Leistung von gegossenen und warm verformten Werkzeugen aus Schnell Arbeits Stahl und ihre metallurgischen Grundlagen."

Thermal tests as well as turning and milling investigations were made, proving that cast tools of high-speed steel perform better than tools manufactured in the conventional way. The composition of the tools covers three series: namely, 2.5 percent Mo, 2.5 percent V and 2.5 percent W; 1 percent Mo, 4 percent V and 12 percent W; and 5 percent Co, I percent Mo, 4 percent V and 12 percent W. The performance of the cast tools was better than that of

Saves 85% gaging time!

"We estimate the DR-25 saves 85% of our time in checking hundreds of cylindrical plug gages every week. We save all the time formerly consumed in gage block build-ups to check each go and no-go gage. Our checks are more consistently accurate since we no longer have to ring gage blocks together carefully and let them cool back to room temperature to keep errors from developing. The generous spindle travel of the DR-25 accommodates a great range of work without accessories. We can now check thread plug and thread setting plug gages in a third of the time formerly required to check them with gage blocks and comparators. We've found the DR-25 rapidly pays for itself in accuracy and man-hours saved."

Charles McArthur,
Gage Engineer
Aeroquip Corporation
Jackson, Michigan

BAUSCH & LOMB
DR-25
OPTICAL GAGE

- Direct scale reading to .0001"
- Accurate to .000025"
- 0" to 3" range without gage blocks

Find out more about cutting inspection time and costs...
MAIL COUPON TODAY

BAUSCH & LOMB
SINCE 1853

Distributed in the U.S.A. through the DoALL Co.

BAUSCH & LOMB OPTICAL CO.
76341 St. Paul St., Rochester 2, N. Y.

☐ I'd like an on-the-job demonstration of a B&L DR-25 Optical Gage. No cost, no obligation.
☐ Please send Catalog D-285.

Name, Title .....
Company .....
Address .....
City ..... Zone ..... State .....

USE READER SERVICE CARD; INDICATE A-5-151

Plastic Steel® saved $180

Within a matter of 2 hours this holding fixture was poured and ready for use at General Electric, and the cost — about $20.00 instead of the original $200.00. Whether you need jigs, fixtures, metal forming dies, molds, models, foundry patterns and core boxes or other special tools, PLASTIC STEEL® and other Devcon products will produce a precision form and save hundreds of dollars and hours.

Hundreds of companies have found money-saving advantages by using PLASTIC STEEL for tooling *and* maintenance. It can be used for repairing worn machine parts, cracked castings, leaking hydraulic systems and tanks, rebuilding worn pumps or valves, etc. — make 1001 on-the-spot repairs.

PLASTIC STEEL® — as easy to use as modeling clay — hardens to steel-like strength in 2 hours . . . can be machined with regular tools . . . bonds all metals, wood, glass, concrete, etc., to itself or each other. It has extremely high tensile, compression and impact strength — excellent chemical resistance.

Find out how PLASTIC STEEL.. and other Devcon products can save time, speed production and cut maintenance costs in your plant — write for FREE bulletin today.

Distributed nationally by leading industrial suppliers

DEVCON corporation

301 Endicott Street, Danvers, Mass.
INDICATE A-5-152-1

conventional tools only when temperatures were not too high.

Carbon content affects productivity also. The advantage of cast tools lies in the fact that special shapes can be more easily produced. Contour milling cutters and similar tools can be cast at less cost than conventional types, often in one piece. Twenty five to thirty five percent reductions in cost have been realized. Cutting speeds up to 100 fpm are recommended, giving better tool life in this range than forged high-speed steel cutters. The wear land—as a criterion for tool life—is likewise reduced at these speeds.

Grinding Wheel Structures

In order to study chip formation and wear in grinding processes, a movie camera attachment has been developed. The attachment is described by K. E. Schwartz in *Industrie Anzeiger*, Vol. 80 (92), 1958, p. 1391-1395, under the title: "Eline Film Einrichtung zur Erfassung der Vorgaenge im Schleifscheiben Gefuege."

The attachment makes it possible to record the reactions of any particular point in the abrasive layer of a grinding wheel. A small camera is used with stroboscopic flash and synchronizing equipment. It is possible to describe the wear processes of grinding wheels in their space and time sequence, and to study chip formation.

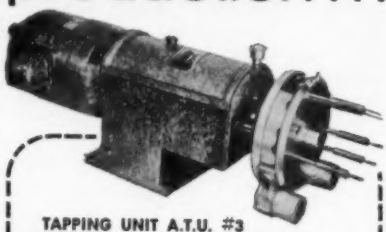
Tool Setting in Turning

In certain cases it is advisable to set turning tools above center, according to an article published by E. Besson in the Swiss periodical *Technische Rundschau*, Vol. 50, No. 42, 1958, p. 17, under the title: "Die Beeinflussung der Spanabnahme durch die Hoeheneinstellung von Dreh-Werkzeugen."

Better tool life is obtained in roughing operations by raising the cutting edge slightly above center—about 2 percent of the work diameter. In the case of carbide tools the cutting edge should not be higher than 1 percent of the work diameter. In finishing operations the tool should be on-center, while a small amount of "above-center setting" is recommended for boring operations.

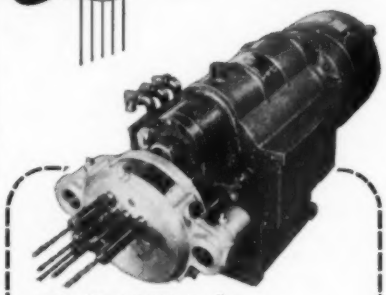
Setting the tool below center is not recommended, because of the tendency toward increased vibration. Although the author does not discuss the reasons for his recommendations, this writer agrees with them. Above-center setting increases the true rake without weakening the tool, but reduces the clearance angle. On the other hand, setting the tool below center reduces the true rake and increases the effective clearance angle. Such an increase reduces the "hold" which the tool has on the work and hence may increase vibration.

The Tap and Drill Team for your hole production . . .



TAPPING UNIT A.T.U. #3
Completely self-contained all-electric lead screw precision unit. Quickly interchangeable for fast single or multiple spindle head operation. With forward and reverse electro-magnetic clutches and variable torque control.

Ettco-Emrick TAP & DRILL TWINS



DRILLING UNIT D.U. #2
Completely self-contained precision unit with powerful air feed and hydraulic control. Quickly interchangeable for fast single or multiple spindle head operation.

Used singly or in combination they offer the flexibility and adaptability to meet modern drilling and tapping requirements. When combined with Ettco-Emrick multiple spindle heads they'll set new standards of precision, speed and economy.

SPECIAL MACHINES
Building the Twins into high production special machines is simple, because all units are electrically controlled and all components are standardized equipment. We can supply the assembly complete with tooling — or you can do it in your own plant.
Write for details

Authorized distributors in U.S. and Canada

ETTCO TOOL & MACHINE CO., INC.
602 Johnson Avenue, Brooklyn 37, N. Y.
Chicago • Detroit • Los Angeles • Indianapolis

The only full line manufacturer covering the entire small hole field: Tapping Attachments • Multiple Heads • Drilling & Tapping Units and Machines • Special Machines • Indexing Fixtures • Tap & Drill Chucks

INDICATE A-5-152-2

.....readers' viewpoints

. . . surface plate specifications

To the Editor

In December's Readers' Viewpoint, the subject of surface plate specifications was discussed by Mr. R. J. Rahn and Mr. J. C. Moody.

As a manufacturer of granite surface plates, I'm quite aware of the confusion that exists about surface plate specifications. Actually more confusion exists today than even a few years back. Much of this trouble, I'm afraid, has been brought about by the manufacturers and their representatives rather than the people buying the plates. Today, we often hear representatives describing surface plate accuracies in such terms as: "straightness per running foot"; "every 2 sq ft of area not to vary more than 0.0005 or 0.0001 inch"; "surface accuracy"; and "indicator reading not to vary more than."

None of the above give a clear picture of the over-all accuracy of the entire area of the plate. For example, nowhere can be found a definition for "surface accuracy," just what does it mean? Similarly, "indicator readings" mean nothing because a gage arm or base can be almost any size.

Mr. Rahn is right in asking for standardized specifications that the average person, whether buyer or engineer, can clearly understand. I believe, however, that his proposed "repeat performance test" is not the answer.

The fallacy of the suggested test is that like the term "surface accuracy," we have also an unknown in the small word "job." Since "job" is not defined by size—and can vary, we aren't getting anywhere. For example, assume our job piece measures 6 x 6 inch. It's not hard to see how when moving it around anywhere on any good surface plate the measurements would repeat to 25 millionths or better. On the other hand, suppose we are checking a worn 6 or 8 ft straightedge for straightness. Admitted, this is a large object. Still, the word "job" applies to it. This straightedge is set up with the working face down on a pair of gage blocks on a 4 x 8 ft surface plate and a series of readings are taken, for example, every 4 inches. Now let us repeat this "performance test" by placing the straightedge in four or five different positions—across the diagonals and down the length of the surface plate at three different places. I'm quite certain there are few plates in existence, laboratory grade or otherwise, where we would obtain consistent repeat readings of 25 millionths. This might be construed as a rigged test to discredit the proposed test. However, it does show us why the "repeat performance test" "job" is not too worthy of consideration.

To give Mr. Rahn due credit for what we believe is the right approach let us go back to June 1954, when one of the trade magazines carried a short article by him titled "Why Don't We Standardize on Surface Plate Specifications?" In this article, he proposed the following specifications:

1. All points on the surface shall lie between two planes separated by the distance equal to the specified accuracy
2. On grade A plates, regardless of size, every two sq ft of area shall be accurate to 0.00005 inch or less, except for an inch or two at some of the edges or corners, which may be well-mouthed an additional 0.00005 inch. On grade B plates these figures are doubled
3. That plates be made in the form of a quite uniform convex arc within the over-all tolerances.

With the above, we have something. Not only do we know the small areas check, we know the over-all accuracy of the plate. There's no confusion, and better, no tricky undefined terms. As a matter of fact, in the manufacture of our granite plates we adhere to these same specifications.

In closing let me say that I wholeheartedly agree with Mr. Moody of the Sandia Corp. when he says a committee on a national level should be formed to resolve this problem. I, for one, would be willing to meet almost anywhere to discuss a standard of specifications that all manufacturers would use. As a starter I would like to propose through your medium that Mr. J. C. Moody be named chairman of such a group with the idea of calling a meeting for discussion on the subject in question.

C. F. Lawley, President
Lawley Granite Surface Plate Co.
Wyoming, Pa.

Heart Surgery

Engineers interested in problems involved in developing new tools for surgery, mentioned in Mr. DeVos' letter published in "Readers' Viewpoint" section in the April issue, may find the article beginning on page 88 of this issue enlightening. Authored by Mel Stone, it discusses the meeting between the surgeons and tool engineers.

A truly high precision chuck developed to meet exacting requirements. The method of clamping the largest possible area of the circumference permits minimum use of pressure; fragile work is never deformed or crushed. In order to maintain this advantage chucks over 4" capacity are equipped with eight jaws.

Removable jaws are available in a wide variety of styles for internal or external chucking, or they may be had in blank form suitable for your own machining.

Simple design permits quick and easy replacement of the shank, and shanks to suit special requirements may be machined at minimum cost in any shop.

Six sizes from 2" to 6" to fit all machines. Furnished with or without shanks

WRITE FOR LITERATURE AND COMPLETE CATALOG

ALINA CORPORATION

122 East Second St., Mineola, L.I., N.Y.

USE READER SERVICE CARD; INDICATE A-5-153

Parker-Kalon has <u>everything</u>. The most complete line of socket screws in the industry and instantly available from your local P-K® distributor.

Top quality and dependability, too. For example, P-K Dowel Pins are precision ground, positively dimensionally accurate. The development of Parker-Kalon's specially heat-treated pin answers the need for maximum holding power in assemblies where parts must be accurately positioned and held in absolute relation to one another. Available in .0002″ standard oversize and .001″ oversize for repairs, they assure perfect alignment and facilitate quick disassembly and reassembly of parts in exact relationship.

The same high P-K Standards apply to Parker-Kalon SHOULDER SCREWS, SET SCREWS, FLAT HEAD CAP SCREWS, BUTTON HEAD CAP SCREWS, PIPE PLUGS and the *new* P-K PRE-LODE . . . the socket head cap screw with the increased bearing surface under the head that gives greater load carrying capacity and permits high tightening—full pre-loading—with no danger of marring or indenting softer material.

KEY SET No. 111 contains 11 sizes of most popular HEX KEYS (Short Arm Series) in a convenient steel case, with easy-to-use key island and simple Table for quick key selection for all types of socket screws.

KEY SET No. 45 offers same 11 Hex Keys in a durable, compact plastic pocket case.

Ask your P-K Industrial Distributor to show you samples of P-K Socket Screws...the industry's most *complete* line!

PARKER-KALON®
Socket Screws

PARKER-KALON DIVISION, General American Transportation Corporation, Clifton, New Jersey. Offices and Warehouses in Chicago and Los Angeles

KEEP AMERICAN INDUSTRY AT WORK, BUY P-K, MADE IN THE U.S.A.

Tech Digests

Casting Large Plastic Tools

L. F. Bogart

The Marblette Corp.
Detroit, Mich.

PLASTIC TOOLING once was constructed mainly with cast phenolic materials. With the emergence of epoxy, a stable resin system when cured at room temperature, the lamination of tools was necessary, due to the limited formulations available. With the development of new formulations, epoxy could be cast in greater masses without the uncontrolled exotherm which ruined both casting and mold. The largest castings of plastic used for tooling would be those made in the construction of draw dies and aircraft stretch forms. During a recent program at the Columbus plant of North American Aviation, castings of over 13,000 lb were made in a continuous operation requiring approximately a day to pour and a night to set.

Before the program of 20 forms was begun, it was necessary to determine the process and material or materials best suited. Investigation indicated that addition of more filler yielded lower cost, acceptable strength, low exotherm, and very little shrinkage from mold dimension. Tests indicated good strengths, even when ratios of 20 parts rock to one part granite aggregate were mixed. For this program, a solid cast with four parts aggregate to one part resin was selected, *Fig.* 1. This low-cost core mix costs less than $20 per cu ft. The resin has a comprehensive strength of 10,800 psi and the core mix has compressive strength of 4100 psi. Special formulations of clear resin and 20 parts gravel show 1500-psi compressive strength which would require a base plate for large tools. For special high-stress tools an aluminum-filled resin is available which yields 13,850 psi with 1½ parts tap rock to one part resin mix.

Surface preparation was selected as a surface coat backed by an 8 by 10 layer laminate of glass cloth, *Fig.* 3.

A metal frame was welded to provide rigidity in the tool, *Fig.* 2. Inserts were mounted in the mold to provide bolting areas for handling the surface laminated, and the slurry of resin and rock added. The base was leveled by applying a casting of machinable aluminum-filled resin to the top of the mold.

The first tools showed a tendency to separate between the laminate and core. This was overcome by using a slow-setting hardener on the surface coat and backing it with a gunk of chopped glass fiber and resin mix used for the core. The core slurry then cross linked with the surface resins since they set at the same time.

A base of gunk made with cotton flock and the core resin was found to be considerably better since it could be applied on a flat surface and the tool lowered on it and leveled. After setting, the tool required only base edge clean-up rather than complete machining of the base.

Twenty forms were cast in ten weeks time, requiring approximately 70,000 lb of resin and 3½ times as much aggregate. The largest tool was approximately 17 ft. long. No base plate was necessary allowing weight savings of better than 50 percent over cored metal tools. These tools were found to be very adequate to forming aluminum

Fig. 1. Mixture of quartz aggregate and core resin being poured into the mold to fill the tool. Plug seal the mounting inserts to prevent damage during the casting of the core.

Fig. 2. A stiffening frame is welded and suspended in the mold after completion of the surface preparation prior to pouring the backing material.

CRAFTS

complete catalogue of DIAMOND DRESSERS for every need

Now ready for you—CRAFTS catalogue of diamond dressers for every need and use. Full prices, specifications and information about re-setting on the famous CRAFTS line. Information too about our inexpensive "Letter Series" of tools. CRAFTS continuous research and job testing provide you with more economical ways to increased production. Always dependable, CRAFTS service reduces costly delays — minimizes downtime.

Mail this coupon for your free Diamond Dresser catalog.

ARTHUR A. CRAFTS Company, Inc.

CRAFTS

601 NEWBURY STREET
BOSTON 15, MASS.
Dept. TE 59

NAME_____

TITLE_____

FIRM_____

ADDRESS_____

INDICATE A-5-156

Fig. 3. Sides of the mold are framed and sealed with plaster, mounting inserts are set in, and a heavy surface coating is applied.

sheet on a 350-ton Hufford stretch wrap press. On one tool, ¼-inch aluminum sheet was formed.

Based on a paper presented at the 15th Annual Technical Conference of the Society of Plastics Engineers, Inc., 665 Prospect St., Stamford, Conn.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

High-Temperature Metals

By Clyde Williams

President
Clyde Williams and Co.
Columbus, Ohio

High-temperature metals are important to our technological future for a variety of reasons. Nuclear power development, improvements in traditional types of power plants, innovations in chemical processing, and developments in transportation will all impose demands for alloys to resist higher operating temperatures.

Most critical at the present, however, are the needs for high-speed aircraft and missiles. These impose requirements so stringent that meeting them will automatically give us materials to satisfy most of the industrial demands. Thus, when we consider the requirements and properties of high-temperature materials for the technological future, we are essentially considering what will be needed for aircraft, missiles, and other flight vehicles now under development or in the conceptional stage.

As was pointed out, aerodynamic heating is a factor that must be considered with new developments in flight, and it is the first metals problem as we go up the temperature scale. At the moment, it is the area of high-temperature technology of much concern to aeronautical engineers.

Until the sonic barrier was first broken, there was no aerodynamic heating problem. But as planes began to fly slightly faster than the speed of sound, the problem was on us. Special high-strength aluminum alloys were designed that have enabled us to fly slightly over Mach 2, or twice the speed of sound, at high altitudes, which is fast enough for present operational aircraft. But the experimental airplanes now being designed, as well as rocket craft and missiles, will travel faster than Mach 2 and will require metals with greater strength and heat resistance than aluminum alloys can give us.

Whatever ingenuity we apply to meet the problem of high temperatures in aircraft, missiles, satellites, or industrial operations, we shall still have to look to a dozen or so metallic elements as our strategic materials. Chromium, nickel, cobalt, columbium, molybdenum, and tungsten seem destined to be the workhorses for the high-temperature age of flight and modern industry. These metals will possibly be aided by titanium, rhenium, osmium, zirconium, tantalum, vanadium, hafnium, boron, and beryllium with of course, manganese, iron and aluminum contributing to basic alloy structures. If, as it seems, a relatively few metals are the key to high-temperature accomplishment, the question naturally arises as to their supply. Does the world have an adequacy of chromium, nickel, cobalt, columbium, molybdenum, and tungsten to meet possible future demands? Specifically, does the United States have access to enough of these superalloy constituents for any eventuality?

The answers to these questions depend on many interrelated factors. They depend not only on the demand for these metals from the aircraft industry but also on the demand generated in other fields of technical endeavor. They depend also on the relative importance of military consumption, changing technologies in both civilian and military production, and the over-all level of economic development. With technological change so rapid, and the variables so many, it is practically impossible to make dependable estimates of future demand for any high-temperature metals.

Straight-line projections of past consumption of production rates, such as can be made with the older materials of our civilization to give some indication as to future probabilities, are useless when dealing with materials that are just coming into significant industrial demand. All we can do it to make conjectures as to possible future demands, in very limited applications, weighing one factor against another and expressing our intuitive conviction as to what the need might be.

Based on a paper for the H. W. Gillett Memorial Lecture presented before the Sixty-First Annual Meeting of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

▼ ▼ ▼

Theory for Effect of Mean Stress on Fatigue of Metals

By W. N. Findley

Professor of Engineering
Brown University
Providence, R. I.

The concept that alternating shear stress is the primary cause of fatigue with the normal stress on the critical shear plane as an influencing factor has been developed for the case of mean (or static) stresses superimposed on combinations of torsion and axial load or bending. The influence of the maximum stress of the cycle of stress on the allowable alternating stress for a given number of cycles and on the orientation of the critical shear plane is explored. The predictions of the theory are consistent with the known trends of fatigue data both for ductile metals and cast irons. The theory explains the fact that the influence of mean stress is weak for torsion and stronger for bending of ductile metals, but strong for both torsion and bending of cast irons.

Based on a paper presented at the Annual Meeting of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

▼ ▼ ▼

Internal Heat Generation in a Liquid Metal

By George L. Muller

Analytical Eng.
Pratt & Whitney Aircraft Div.
United Aircraft Corp.
Middletown, Conn.

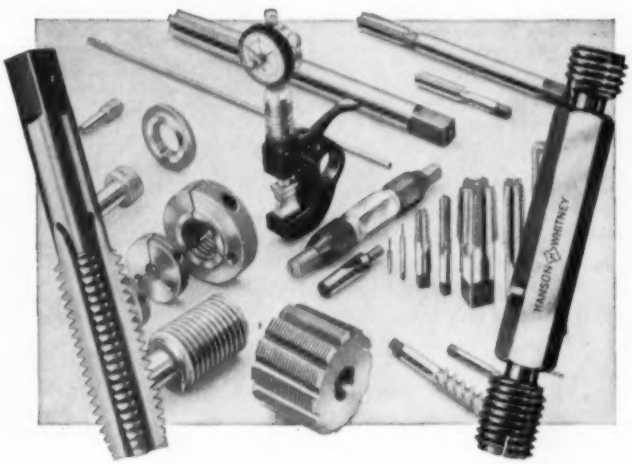
The phenomena associated with a liquid metal flowing turbulently through an insulated pipe when heat is generated uniformly in the fluid was investigated experimentally. The results

New:

Hanson-Whitney's new production techniques give you *consistent* quality cutting edges with *"free-cutting action"* for increased productivity. These advances in Hanson-Whitney standard cutting tools mean longer tool life—uniform size and less binding. And you protect your threading investment from start to finish, with Hanson-Whitney's *related* line of standard Thread Gages—keeps your profit dollars up, where they ought to be.

Complete and Related "STANDARDS"

Your Hanson-Whitney distributor puts a *complete and related* line of standard *"free-cutting action"* tools and gages at your finger tips. He is your threading specialist backed up by Hanson-Whitney's forty years of thread engineering and experience. Call him now.



Hanson-Whitney COMPANY

204B BARTHOLOMEW AVE., HARTFORD, CONN.

STANDARD: Taps • Thread Gages • Cutters • Fine Pitch Gear Hobs

USE READER SERVICE CARD; INDICATE A-5-197

Right down the line

BAIRD

is your BEST BUY in 4-SLIDES

Built in the U.S.A. to machine-tool standards of **QUALITY.**

ALL PARTS for **ALL SIZES** always in stock.

Extremely ACCURATE

TOOLING INTERCHANGEABLE one machine to another of same size.

VERSATILITY limited only by ingenuity of tooling.

EASIEST to tool and adjust.

BAIRD pioneered the modern 4-slide. Ask us about its potential as a COMBINED-OPERATION COST-CUTTER. Write Dept.' TE.

THE BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

BAIRD — Six and Eight Spindle Chuckers • Automatic Multiple Transfer Presses • Automatic 12 Station Duplex Turning Machines • Vertical Continuous Lathes • Automatic Four Slide Machines • Pneumatic Ribbon Metal Forming Machines • Barrel Finishing Machinery • Machinery for Chain and Roller Chain Production, Garment Hook and Eye Production • Precision Bench Presses

USE READER SERVICE CARD; INDICATE A-5-158

4BA58

are compared with the analysis of H. F. Poppendiek using the heat-momentum transfer analogy of Martinelli. A direct test of the analogy is afforded, since there is no heat transferred to the wall, and interfacial resistances cannot affect the results. The results have application to liquid-metal-fueled nuclear reactors, where heat is generated in the fuel as it flows through the core. Poppendiek's analysis is reworked into an integral form similar to that given by Lyon for the heat-transfer coefficient so that the effect of internal heat generation on the coefficient can be more clearly seen.

Based on a paper presented at the ASME-AIChE Joint Heat Transfer Conference, Chicago, Ill., for the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Mineral Exploration Economics

By James Boyd

Vice President
Kennecott Copper Corp.
New York, N. Y.

One of the main drawbacks to the proper application of scientific approaches to exploration lies in the infancy of the basic science itself. There has not been the stimulus of necessity back of minerals research, a factor that has forced the advance of basic research in medicine, metallurgy, chemistry and physics. Our knowledge of the fundamentals governing the origin of ore deposits is largely lacking, and there is an enormous amount of basic research necessary to provide the applied exploration scientists with a reservoir of ideas on which to work. Several attempts have been made in recent years to channel the flow of funds into fundamental geological sciences. The National Science Foundation has recognized the need for this and has attempted some activities in this direction, but a great deal more scientific investigation into the origin of the concentration of ore minerals in the earth's surface must be undertaken before long-range scientific exploration can become sufficiently economical to meet future industrial requirements.

Resources are governed in the end by the actions of men and not by geochemi-

cal processes. The future of our industrial society will be determined by what we do to encourage research, through exploration and other means, into new minerals technology. Nothing will be accomplished through increased taxation or the setting aside of vast areas closed to prospecting for perpetuity.

Unfortunately, the minerals producer is finding it increasingly difficult to undertake new ventures, and before a final decision is reached in reviewing problems of conservation as applied to exploration, we must decide whether we really desire or need resources at a lower cost per unit for the future. The decision is up to all of us.

Based on an address presented at Resources for the Future Forum, Washington, D. C.

▼ ▼ ▼

Statistics for Dimensioning Machine Parts

By M. F. Spotts

Professor of Mechanical Engineering
Northwestern University
Evanston, Ill.

An outstanding industrial achievement during recent years has been the development of quality control and acceptance sampling methods for the purpose of maintaining the high standards of manufactured products. It is equally important to make use of statistics in the engineering office in connection with the dimensioning of machine parts. This paper is concerned with the dimensioning of assemblies, and will demonstrate how it is possible to maintain tolerances for proper engineering functioning, and at the same time widen the tolerances so far as production is concerned.

Based on a paper presented at the Annual Meeting of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

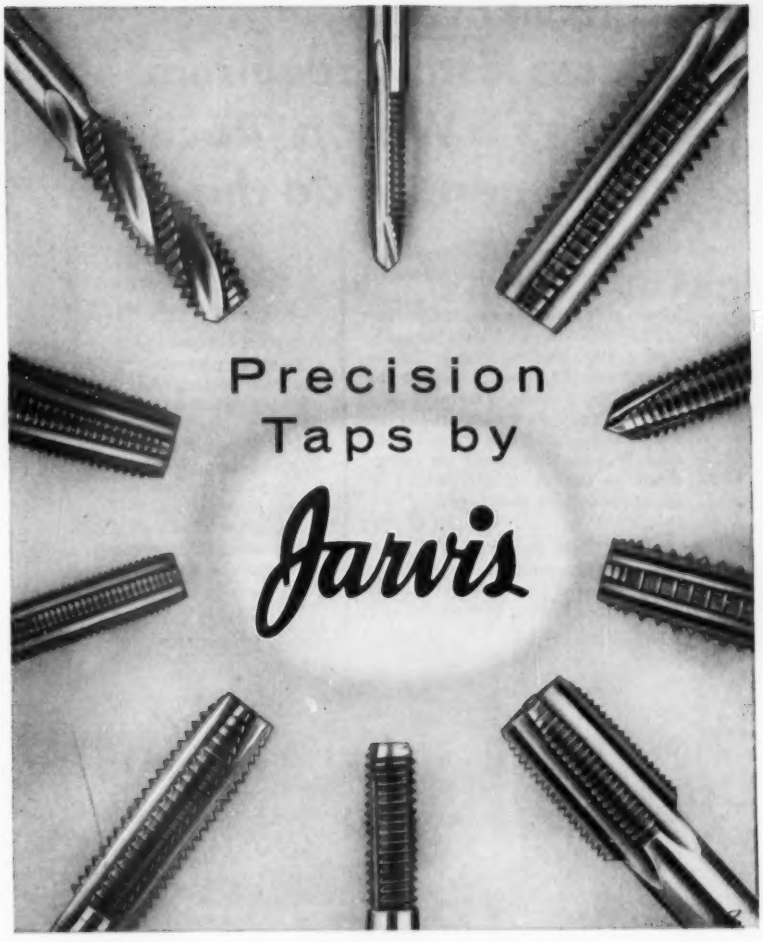
▼ ▼ ▼

Techniques of Evaluating Epoxy Foams

By C. L. Segal

Hughes Aircraft Co.
Culver City, Calif.

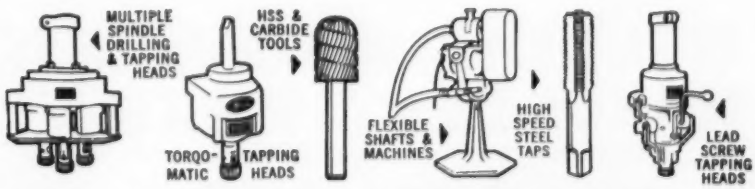
Epoxy resins have excellent electrical, mechanical and thermal properties, and epoxy foams consequently have great potential importance for electronic and missile applications. Wherever there is a need for reduction in material weight without sacrificing physical integrity at elevated temperatures, epoxy foams



A complete line of High Speed Steel Taps, precision ground from the solid by Jarvis. Hand taps . . . machine screw taps . . . stub taps . . . pipe taps—Jarvis makes them all—plus special taps to meet unusual requirements. Constant quality control at every stage of manufacture assures superior performance, longer tap life.

For expert advice on all tapping problems, Jarvis is always at your service. A Jarvis representative is as near as your phone.

Send today for the Jarvis Tap Catalog.


MULTIPLE SPINDLE DRILLING & TAPPING HEADS
HSS & CARBIDE TOOLS
TORQO-MATIC TAPPING HEADS
FLEXIBLE SHAFTS & MACHINES
HIGH SPEED STEEL TAPS
LEAD SCREW TAPPING HEADS

JARVIS CORPORATION • MIDDLETOWN, CONNECTICUT
USE READER SERVICE CARD; INDICATE A-5-159

For almost every hardness testing requirement

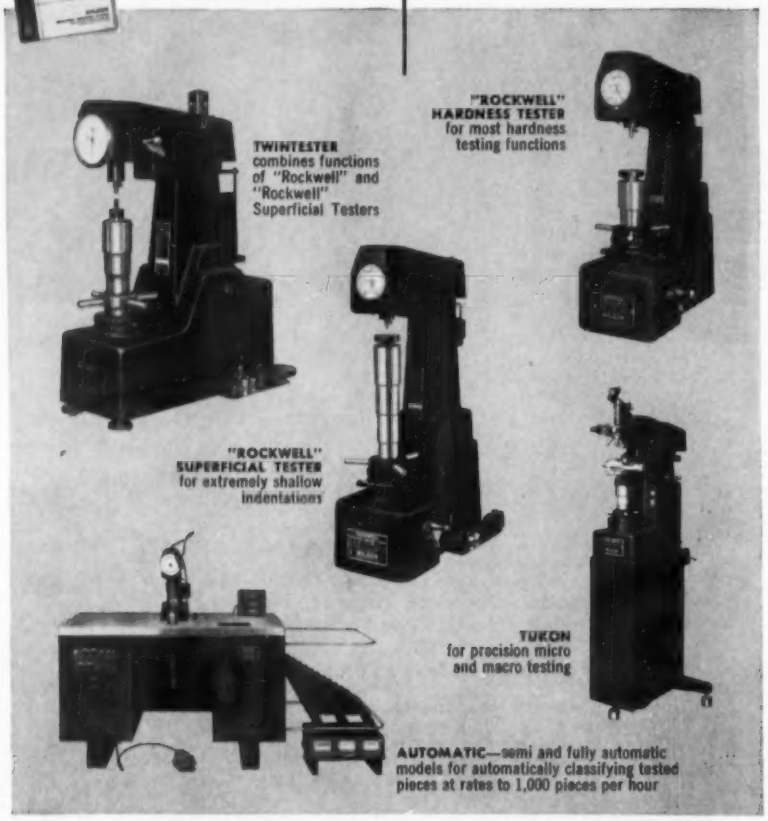
There's a Wilson "Rockwell" instrument to do the job

Wilson "Rockwell" Hardness Testers can help make your products better, stronger, longer lasting. They give reliable results on the production line, in laboratories, in tool rooms, and in inspection departments. They're as easy to use as a center punch, as durable as a machine tool, as sensitive and accurate as a precision balance. That's why Wilson "Rockwell" is recognized as the world's standard of hardness testing accuracy.

Wilson "Brale" Diamond Penetrators give Perfect Readings

A perfect diamond penetrator is essential to accurate testing. Only flawless diamonds are used with Wilson "Brale" penetrators. Each diamond is cut to an exact shape. Microscopic inspection and a comparator check of each diamond—one by one—assure you of accurate hardness testing every time.

Write for Catalog RT-58. It gives complete details on the full line of Wilson hardness testing equipment.


TWINTESTER
combines functions of "Rockwell" and "Rockwell" Superficial Testers
"ROCKWELL" HARDNESS TESTER
for most hardness testing functions
"ROCKWELL" SUPERFICIAL TESTER
for extremely shallow indentations
TUKON
for precision micro and macro testing
AUTOMATIC—semi and fully automatic models for automatically classifying tested pieces at rates to 1,000 pieces per hour

WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-H Park Avenue, New York 17, New York
USE READER SERVICE CARD; INDICATE A-5-160

may be applied to advantage.

Four commercially available epoxy foams, having different processing characteristics and densities, were chosen for evaluation. Electrical properties, such as insulation resistance, volume resistance, dielectric strength, dissipation factor, and dielectric constant were determined. In addition, several mechanical and thermal properties were evaluated. These properties were compression and shear strength, thermal conductivity and expansion, and flammability. The effect of moisture upon the characteristics of the foams was also investigated.

Standard test methods are available for certain mechanical and thermal properties of foam at low temperatures. Proposed test methods for electrical and thermal properties at high temperatures are being investigated by several of the plastic societies.

Based on a paper presented at the Epoxy Resin Symposium of the Society of Plastics Engineers, Inc., 65 Prospect St., Stamford, Conn.

▼ ▼ ▼

The Maintenance Engineering Program

By Roy H. Larson

Vice President
Indiana Forge & Machine Co.

Opportunities in maintenance engineering emphasizes one of the phases of the operations of all plants today that are getting a lot of attention from top management. This is the plant's maintenance program.

It would be well to mention the statement of Mr. John P. Moser, production vice president of the Lever Brothers Co., "Some companies have failed, I believe, simply because they were too parsimonious to let their plant engineers keep the plant in good order for them." He further states, "Maintenance, which in our company reports to the plant engineering department, will be upgraded, and if you already have good tradesmen they will be quite capable of taking on this new work load."

This development in most plants is brought about by the economic necessity of keeping the present equipment in top operating condition, since most plants do not have sufficient working capital to replace equipment at today's high replacement cost, and also productivity must be improved to reduce unit production cost.

Based on a paper presented at the Maintenance Engineering Conference in Cleveland, Ohio, of the Drop Forging Association, 55 Public Square; Cleveland 13, Ohio.

Prismatical Bar Torsion

By F. Sisto
Propulsion Division Chief
Curtiss-Wright Research Div.
Clifton, N. J.

The Saint Venant torsion problem is solved for a region bounded by two circular arcs forming a crescent. The region is conformally transformed to an infinite strip and the stress function is obtained by Fourier integral. Subsequent quadratures for evaluation of the torsion constant are obtained explicitly with the exception of a single infinite integral which may easily be evaluated numerically. Some values of the torsion constant are given, and an approximate formula valid for small "camber" is available.

Based on a paper presented at the Gas Turbine Power Conference of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Effect of Ambient and Fuel Pressure on Spray Drop Size

By S. M. DeCorso
Westinghouse Research Lab.
Pittsburgh, Pa.

After a brief review of existing knowledge concerning the effect of ambient pressure on spray drop size, results are presented for a swirl nozzle at fuel Δp's of 25 and 100 psi for ambient gas pressures of 0.5, 14.5 and 114.5 psia. The liquid sprayed is diesel fuel, the nozzle capacity being 45 gph at 100 psi Δp, and the nominal spray angle, 80 deg. The photographic method by which drop size was determined is described. Curves are presented which show the spatial variation in fuel flow rate, spray-stream velocity, and drop size. The notable effects are large drop size and velocity variations across the spray stream, and for the total nozzle output, an increase in the drop size as the ambient pressure goes from 14.5 to 114.5 psia.

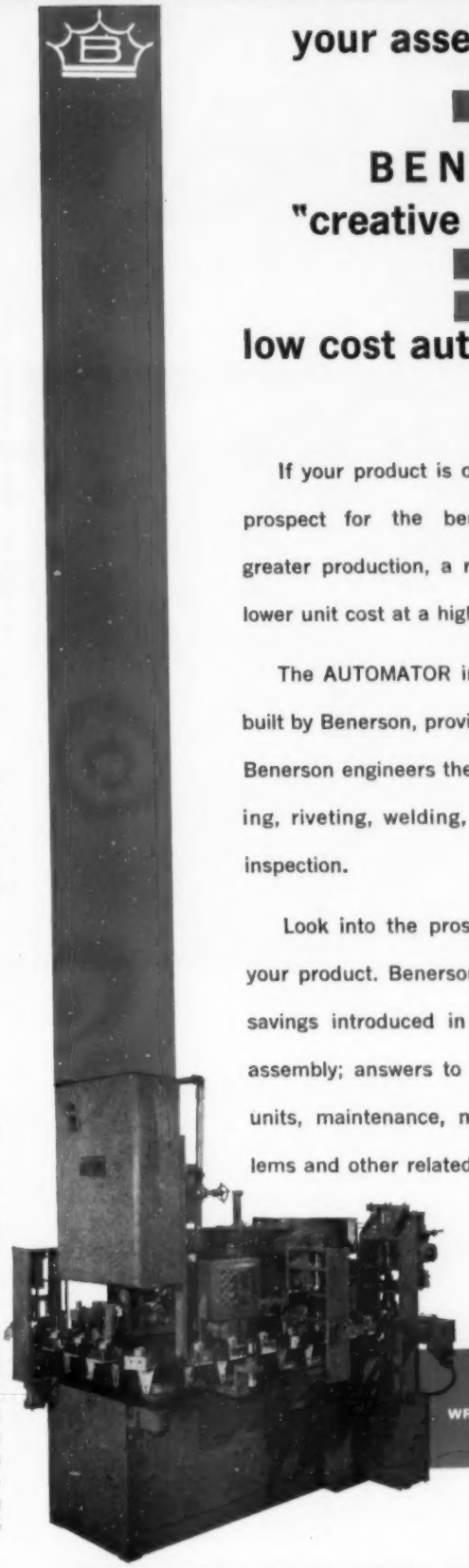
Based on a paper presented at the Gas Turbine Power Conference of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

your assembly problem
+
BENERSON
"creative engineering"
=
low cost automatic assembly

If your product is one of volume production, it is a prospect for the benefits of automatic assembly: greater production, a reduction in scrap which creates lower unit cost at a higher quality level.

The AUTOMATOR indexing chassis, engineered and built by Benerson, provides the starting point from which Benerson engineers the fixtures and devices for machining, riveting, welding, sorting, orienting, feeding and inspection.

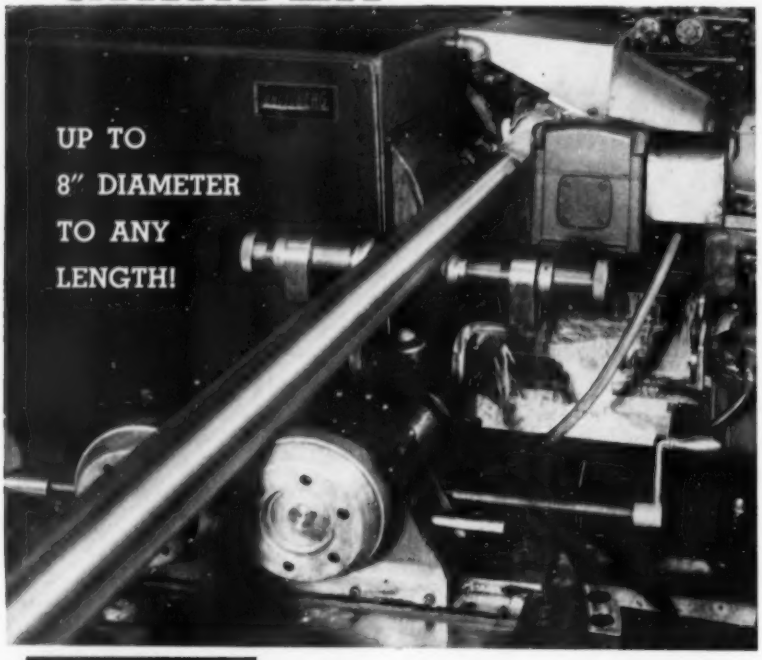
Look into the prospects for automatic assembly of your product. Benerson offers you specific examples of savings introduced in other plants through automatic assembly; answers to your questions on size, range of units, maintenance, mixing operations, redesign problems and other related facts.



WRITE NOW FOR FURTHER INFORMATION

BENERSON
CORPORATION
BOX 4126, STATION A, EVANSVILLE, INDIANA
"First Name in Automatic Assembly"

NEW HEAVY-DUTY CENTERLESS GRINDER



ENGELBERG 8132-HD removes 3 lbs. metal per minute!

Loaded with "firsts," the Engelberg 8132-HD now makes possible exceptionally heavy single pass stock removal, extremely fine finishes, close tolerances on any rod or tube stock.

New large workpiece capacity—precision grinds and finishes any length, takes diameters from 1" to 8".

New powered outboard support system—main power unit controls synchronized "slave" units for variable through feed rates.

New automatic reverse feed—microswitch controls automatically change helix angle of outboard support power units and regulating wheel to reverse feed direction for multiple through feed passes; eliminates intermediate material handling.

New highs in production—Ex: 416 stainless steel bars 5.060" diameter, 20' length; removal .018" stock per pass at feed rate of 70" per minute. 1020 steel tubes 6¼" diameter, 10' length; removal .015" per pass at feed rate of 3' per minute.

Write today for new bulletin: **New Savings With Centerless Belt Grinding**

ENGELBERG, INC.

Precision **ABRASIVE MACHINE TOOLS**

108 SENECA STREET • SYRACUSE 4, N. Y.

USE READER SERVICE CARD; INDICATE A-5-162

Finishing Hard Gears

By H. Pelphrey

Director of Research
Michigan Tool Co.
Detroit, Mich.

By using an abrasive gearlike tool, material can be removed from the flanks of gear teeth without the necessity of the two being otherwise geared together. The tool and work are not presented to each other with their axes in the same plane but are crossed in the same manner as used in the well-known process of gear shaving. The purpose of this process, as may be gathered, is to improve gear-tooth action at a low cost. This improvement can be realized by one or more of the following: (a) Remove burrs and projections thrown up around nicks; (b) improve surface finish; (c) lead; and (d) profile.

Based on a paper presented at the Annual Meeting of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Heat Transfer Surface Characteristics

By W. M. Kays

Professor of Mechanical Engineering
Stanford University
Stanford, Calif.

The basic characteristics of six new compact high-performance surfaces are described. Four are of the strip-fin type, including three stacked in a unique multiple sandwich arrangement. One of the surfaces has perforated fins formed by punching circular holes through the fins, and one has wavy fins. The basic characteristics are presented in terms of $N_{St}N_{Pr}^{2/3}$ and f versus Reynolds number. A sufficient geometrical description is provided so that the data are readily usable in heat exchanger design analysis. The triple-sandwich surface introduces some new complications in the analysis of the effectiveness of the fins.

Based on a paper presented at the Gas Turbine Power Conference of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

LOOK!

LOGAN HAS IT!

RIGHT PRICE

TOP QUALITY

PEAK PERFORMANCE

the most complete line of

POWER CHUCKING EQUIPMENT

LOGANSPORT MACHINE CO., INC.
839 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

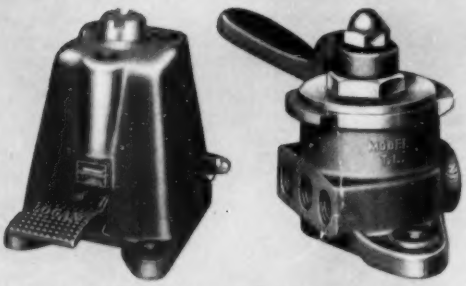
- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-6 ULTRAMATION CYLINDERS
- ☐ 300-2 PRESSES
- ☐ FACTS OF LIFE
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLS.
- ☐ 200-3 750 SERIES HYD. CYLS.
- ☐ 200-4 AND 200-7 HYD. VALVES.
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 300-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

NAME_____ TITLE_____

COMPANY _____

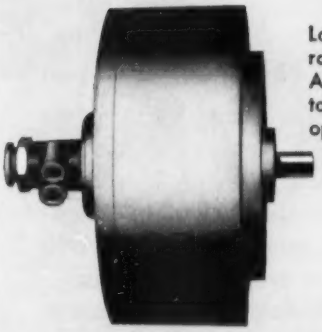
ADDRESS _____



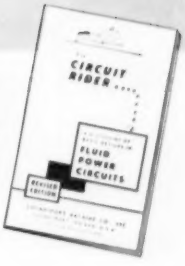
Logan Control Valves—Complete line of actuators available—for manual, semi-automatic or automatic control.

Model 400 RFL Unit Reducing Valve, pressure gauge and lubricator in compact aluminum housing.

Logan Standard Chucks from 6" to 24" diameter; specials to meet your needs.



Logan Double Acting, rotating type cylinders. Air operated sizes 1½" to 20" bore. Hydraulic operated 3" to 14" bore. Hollow or closed center.



FREE **SEND FOR YOUR COPY OF LOGAN "CIRCUIT RIDER"**

A 32-page manual on fluid power circuits (fifth edition) completely revised to present current engineering trends.

MEMBER: Natl. Mach. Tool Builders' Assn. Natl. Fluid Power Assn.

save tooling dollars

with this versatile, quick set-up

DUMORE

AUTOMATIC "DRILL-N-TAP" UNIT

Only $825 *
Complete tool, ready to operate —includes reversing motor, electric tap control, pulleys, chuck.

Do all these operations—*and more*

TAP • DRILL • REAM • CHAMFER
SPOT-FACE • CENTER • DEBURR

Plug it in and it's ready to go

—Any unskilled laborer can learn to operate it in minutes. Once set, it's always set — minimizes scrap loss, drill breakage and eliminates operator fatigue slowdowns. Changes easily, quickly from job to job, operation to operation, for long or short runs. Precision engineering, famous Dumore quality workmanship and separate, isolated hydraulic and pneumatic systems provide trouble-free service over millions of cycles. Less than one cubic inch of air required . . . a cost-cutting feature.

The Dumore Series 28 "Drill-N-Tap" Unit

can be a drilling or tapping machine with just the flip of a selection switch. Tap fits into chuck, no extra attachments required. Reversing motor controls tap, eliminates troublesome clutches. Adjustable, positive spindle speeds from 265 to 4900 rpm. Can be set up for operation in 5 minutes—on drill press or special machine, with simple nose bracket. *For more details, send coupon.*

NOSE MOUNTING BRACKET
Your Key to all-purpose machining—**anywhere.** It permits fast, easy mounting in any position, angle or direction in single set-ups, or multiple operations in sequence.

You can save hundreds of dollars in first cost alone with these DUMORE AUTOMATIC DRILL UNITS

SERIES 24 DRILL UNIT
Fully automatic with all controls built-in for short or long runs and frequent changeovers. From $613*
SERIES 26 DRILL UNIT
Same as Series 24 with just basic controls built-in for long, uninterrupted runs. From $505.50*
SERIES 20
Built-in adjustable controls—automatically selects proper speeds/feeds. No. 80 to 5/32" drill capacity. From $217.50*.

*FOB Racine

BUILDING-BLOCK ACCESSORIES FOR AUTOMATIC PRODUCTION

MULTIPLE SPINDLE ATTACHMENT fits units 28, 24, 26. For simultaneous drilling or tapping of 2, 3 or 4 holes. Quickly adjustable center distances.

COMPLETE DRILL PRESSES AND TABLE FIXTURES
Includes Circular and Rectangular Fixture Presses, Cross Arm Bar Assemblies, Circular Production Tables, Variety of Brackets, Control Components and other units to provide complete parts needed for building your own single or multi-purpose drilling or tapping machines for lower cost production.

AND THESE HANDY, USEFUL TOOLS

DRILL GRINDER, resharpens and precision points drills up to ¼".

MICRO-DRILL for drilling holes as small as .0001" diameter, without skilled operators.

HI-SPEED DRILL PRESS, hand operated, bench type, 0-⅛" capacity. And, DRILL SPEEDER, right, fits standard drill press, 17,000 rpm. 0-⅛" capacity.

Sold and Serviced Thru Leading Industrial Distributors Everywhere

You Can Do More with DUMORE

ALL PURPOSE PRECISION METALWORKING TOOLS

VERSA-MIL • DRILL-N-TAP UNITS DRILLING UNITS • DRILL HEADS MICRO-DRILLS • DRILL GRINDERS PRECISION GRINDERS • HAND GRINDERS • FLEX-SHAFT TOOLS • QUILLS AND ACCESSORIES

THE DUMORE COMPANY • 1310 Seventeenth St. • Racine, Wisconsin

Clip to your letterhead

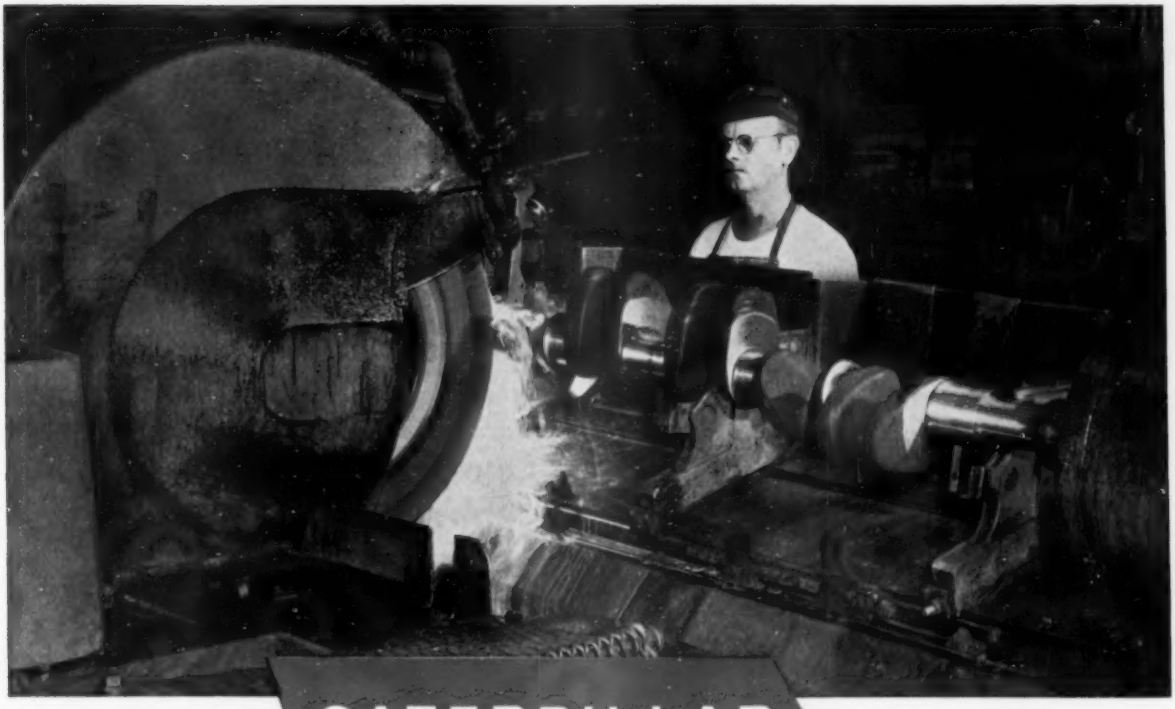
Send me Drill Unit details

Your Name_____

OK . . . for precision grinding at high production speeds

SIMONDS ABRASIVE CO.

CRANKSHAFT GRINDING WHEELS



ON THE JOB AT Simonds Wheel used on crankshaft grinding at Caterpillar Tractor Co. Plant, Peoria, Ill.

CATERPILLAR
REG. U. S. PAT. OFF.

Fast and free-cutting these wheels hold up well on the corners, maintain radii and need only the minimum of dressing. Also supplied in matched, counter-balanced sets for multiple spindle set-ups . . . with each wheel marked with set number and with red stripe for accurate line-up on the spindle. Typical specifications for main or line bearings, JA543-05-V1 (multiple set-up) . . . for pin bearings, JA543-Q5-V1 (single wheel set-up). Write for Bulletin ESA 263.

CALL YOUR SIMONDS DISTRIBUTOR

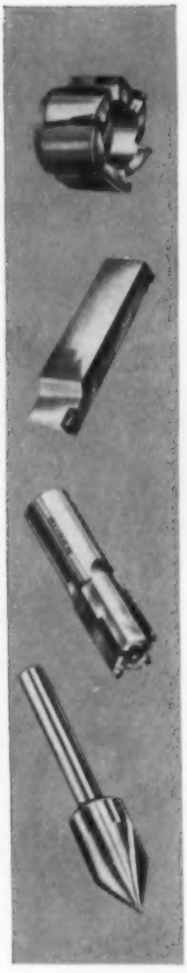
Proven products
Dependable know-how
Quick supply

SIMONDS ABRASIVE COMPANY
Tacony & Fraley Sts., • Philadelphia 37, Pa.
Division of Simonds Saw and Steel Co.

BRANCHES: CHICAGO • DETROIT • LOS ANGELES • PHILADELPHIA • PORTLAND, ORE. • SAN FRANCISCO • SHREVEPORT

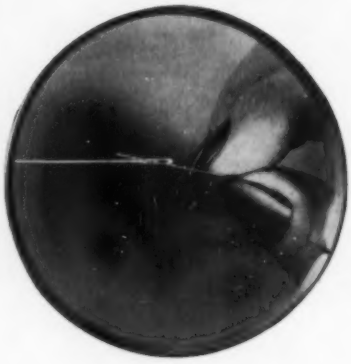
NOW AVAILABLE . . .

MINIATURE SIZE
DRILLS, REAMERS and END MILLS



Super

.024 up on Drills
.032 up on End Mills
.041 up on Reamers



ESPECIALLY ADAPTABLE TO YOUR MISSILE AND AIRCRAFT PROGRAM

Super Tool produces the most complete and advanced line of quality carbide tools on the market today. A new line of small drills, reamers and end mills has just been added to meet the requirements of modern industry. All Super drills are immediately available from stock.

Super TOOL COMPANY

21650 HOOVER RD.
DETROIT 13, MICHIGAN
Division of Van Norman Industries, Inc.
Warehouses: Chicago • Detroit • New York
Los Angeles

SUPER TOOL COMPANY
Division of Van Norman Industries, Inc.
21650 Hoover Rd., Detroit 13, Michigan

Gentlemen: Please send literature describing Stub Screw Machine Reamers to:

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____
I am also interested in Standard Carbide: ☐ Drills ☐ Milling Cutters ☐ End Mills ☐ Other Reamers ☐ Special Carbide Tools

USE READER SERVICE CARD; INDICATE A-5-166-1

AK BED TURRETS

NOW YOU CAN DO MULTIPLE MACHINE OPERATIONS

The extra heavy duty AK Bed Turret will convert your engine lathe into a ram-type turret lathe for production that would normally require several machine operations. This heavy duty, self-indexing, precision bed turret with six station meehanite head, has been specially designed and engineered for the larger lathes in the 13" to 16" range.

Two models to choose from, either the straight ram or the tilt head ram (5° angle). The tilt head model allows greater clearance over the ram, enabling larger tools to be utilized.

All tool holes are blank to permit user to align them with spindle hole. Complete instructions furnished for mounting turret and machining holes.

- Manufacturer of PRE COR TOOLS: Collet Closer Attachments.
- Also Manufacturers of AK Bed Turrets, Cross Slides and Bar Feeds.

OTHERS AVAILABLE - 10"TO 16"

SEND FOR FREE LITERATURE

PRECISION PROCESSING CO.
3269 Casitas Ave., Los Angeles 39, Calif.

USE READER SERVICE CARD; INDICATE A-5-166-2

Opportunities
. . . With A Growth Company

MACHINE SHOP SUPERVISOR
Opening for H.S. graduate with advanced technical training who has 5 to 10 years' general machine shop supervisory experience, including knowledge of incentive systems.

TOOL STANDARDS PLANNER
Experienced in preparing and writing general manufacturing standards including tools, tool components and gages.

Kindly send resume and salary requirements to

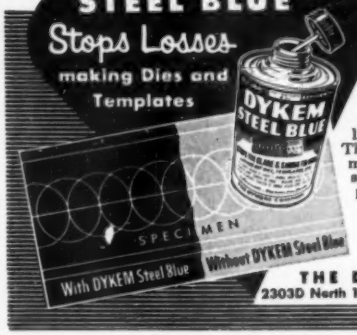
FRED A. WETERRINGS
Industrial Relations Division

HALOID XEROX INC.
6 HALOID STREET, ROCHESTER 3, NEW YORK

USE READER SERVICE CARD; INDICATE A-5-166-3

DYKEM STEEL BLUE

Stops Losses making Dies and Templates



Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303D North 11th St. • St. Louis 6, Mo.

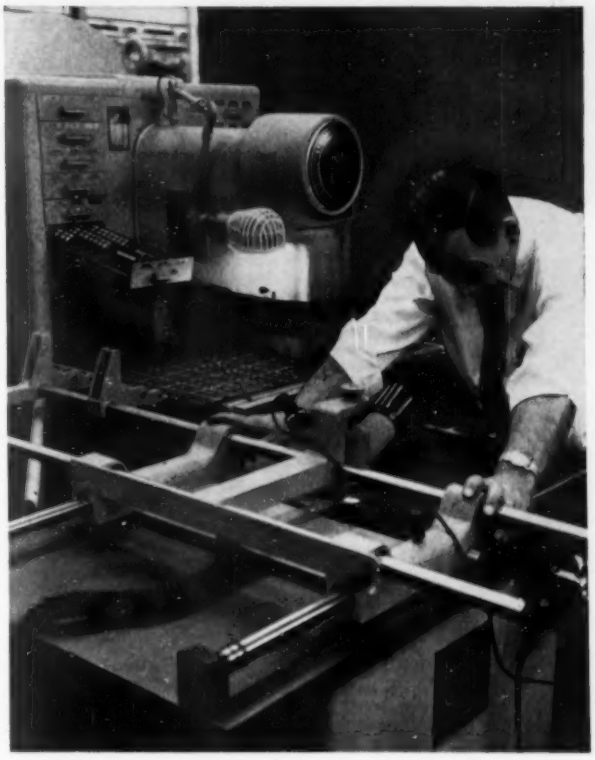
USE READER SERVICE CARD; INDICATE A-5-166-4

Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

It's so easy to punch hole patterns fast with BTR

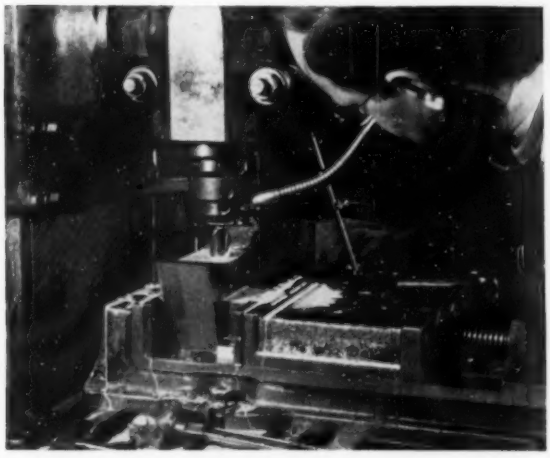


A punch made from BTR tool steel is the key element in this punching mechanism. It speeds the accurate reproduction of hole patterns, by remote control from a template, in sheets of steel, brass, aluminum, or plastic.

The BTR punch has proved both reliable and economical. This is the report from Wales-Strippit Inc., Akron, N. Y., a unit of Houdaille Industries, producers of the equipment. The Bethlehem tool steel is supplied by Leed Steel Co., Buffalo, one of our local tool steel distributors.

BTR is Bethlehem's general-purpose manganese-chromium-tungsten grade of oil-hardening tool steel. It's safe hardening, easy to machine. Combining abrasion-resistance and toughness, it's ideal for a wide range of tool and die uses.

Put BTR to work in your shop. A trial order can be delivered quickly by your Bethlehem tool steel distributor who carries BTR in stock in a wide size range.



New Free-Machining Tool Steel

Bethlehem Air-4 is an air-hardening tool steel which can save you time and money in scores of applications. It is a free-machining grade, and hardens at about 1550F. It combines excellent wear-resistance with a high degree of toughness. Ask your distributor for full data on Bethlehem Air-4.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Decarburized surfaces are the cause of premature tool failures

The great majority of toolmakers know that decarburized metal must be removed completely from the working surfaces of tools. It is not so widely known that it is often best to remove this skin from other portions of the tool.

This precaution is especially necessary on tools which are subject to repeated impacts. For example, a pneumatic chisel which has a forged shank often breaks because of a fatigue failure. As a rule there is a stress concentration in the shank, due to the change in section. When this tool surface is also decarburized, rapid failure in service can occur.

The outer layers of a decarburized tool haven't the strength of the effectively hardened tool steel base. Therefore only one procedure can be considered safe. It is to grind off the "decarb" on *all* tool surfaces.

USE READER SERVICE CARD; INDICATE A-5-167

Save 80% power cost!
Save 30% wheel cost!

THOR

360 CYCLE HIGH FREQUENCY

ELECTRIC GRINDERS

Remove metal 25% faster!

FOR removing metal with maximum speed at minimum cost, no other power tool even comes close to the performance of Thor 360 Cycle High Frequency Electric Grinders.

This Thor Grinder will remove up to 25% more metal than a comparable air grinder can remove in the same time. By using wheels designed for speed, you get maximum cutting power from the abrasives, and save up to 30% on wheel cost. Because efficiency is constant, with never more than 8% loss of speed under full load, you save 80% on power cost. Records prove that the minimum overall saving is 30%.

There is no governor control on a Thor 360 Cycle Grinder. Electric power frequency controls the speed, making it as reliable as an electric clock. The mechanical simplicity of the 3-phase Thor induction motor assures long service and low maintenance cost.

Thor 360 Cycle Grinders are made in five models and 21 speeds, from 3700 to 21,600 R.P.M. Thor's complete line of high frequency electric, universal electric, and air grinders includes sizes, speeds and capacities for every industrial need. Thor also offers a complete line of grinder accessories. Thor Power Tool Company, Aurora, Illinois.

Model G37 . . . 17½" long . . . Weight 8½ lbs. . . . RPM 6,000, 8,000, 9,500, 12,000

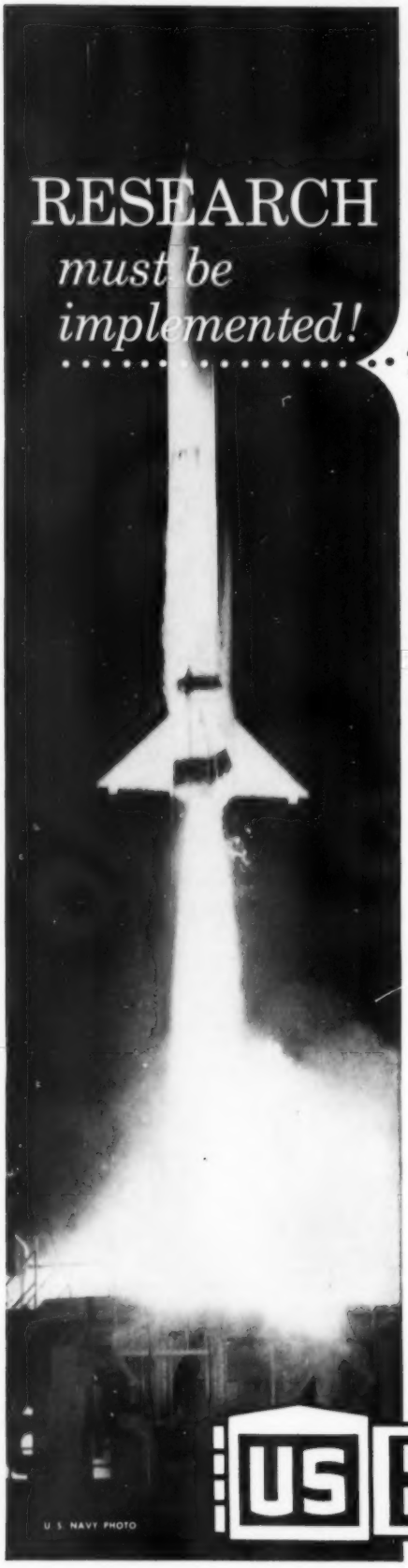
Thor
PORTABLE POWER
TOOLS

THOR POWER TOOL COMPANY
AURORA, ILLINOIS

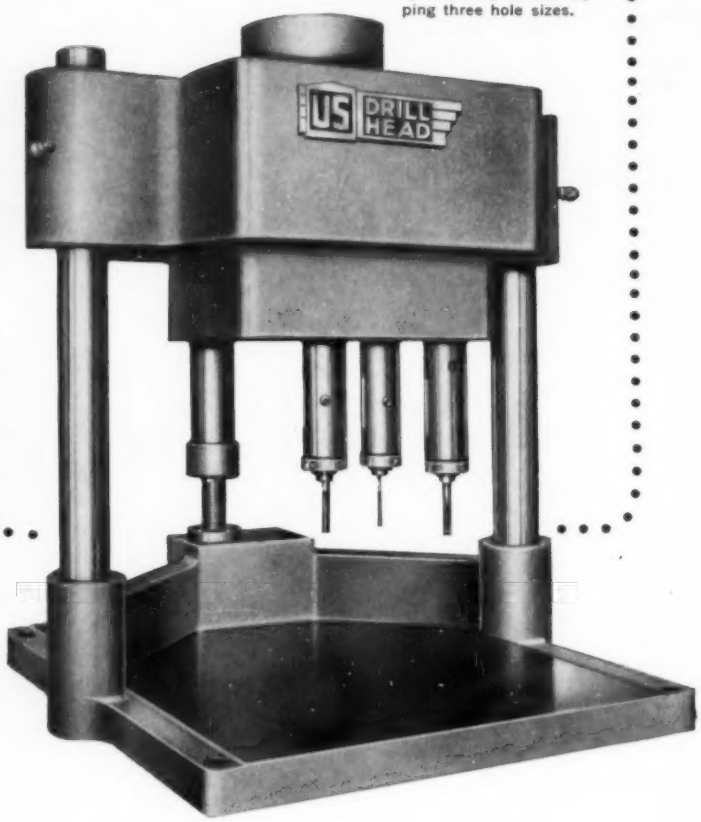
ATLANTA • BIRMINGHAM • BOSTON • BUFFALO • CHICAGO
CINCINNATI • CLEVELAND • DENVER • DETROIT • HOUSTON
INDIANAPOLIS • KANSAS CITY, MO. • LOS ANGELES • MILWAUKEE
NEWARK • LONG ISLAND CITY, N.Y. • PHILADELPHIA • PITTSBURGH
RICHMOND • ST. LOUIS • SAN FRANCISCO • SEATTLE
TORONTO, ONT., CAN. • EXPORT DIVISION, NEW YORK CITY

When the urgent demands of our missile program required heat treating equipment far beyond conventional standards, Lindberg filled the need with this remarkable furnace installation. In a few months, this gantry-type, bottom quench, atmosphere furnace and its attendant facilities were designed, installed and put into operation at Lindberg Steel Treating Company, Melrose Park, Illinois, by Lindberg engineers and technicians. This accomplishment was no sudden inspiration, but was made possible by Lindberg's long years of experience in creating industrial heating equipment of every kind . . . heat treating, melting, brazing and enameling furnaces, high frequency units, ceramic kilns, pilot plant and laboratory furnaces . . . either electric or fuel fired. Whenever a product needs heat you can count on Lindberg to know how best to apply it. See your local Lindberg Field Engineer or write us direct. Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12, Ill.

LINDBERG heat for industry



3-spindle U. S. Fixed Center Head with auxiliary lead screw tapping spindle for precision tapping three hole sizes.



. . . and, that's the business of manufacturers.

In practically all manufacturing, the most common operation is the production of holes. And, for cost-reducing production of precision multiple-hole patterns in your manufacturing— that's OUR BUSINESS!

Get low-cost

MULTIPLE-HOLE LEAD SCREW TAPPING ON A DRILL PRESS with U. S. Heads

Where precision tapping of multiple-hole patterns is required on high or low production runs, do the job on a drill press with a U. S. Master Lead Screw Head. These special fixed center heads are built with varying number of spindles and tap sizes in any one head—exact gear ratio required to each spindle as well as to master lead screw. Use on any drill press having reversing spindle.

Ask Our Engineers To Talk With Yours

US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

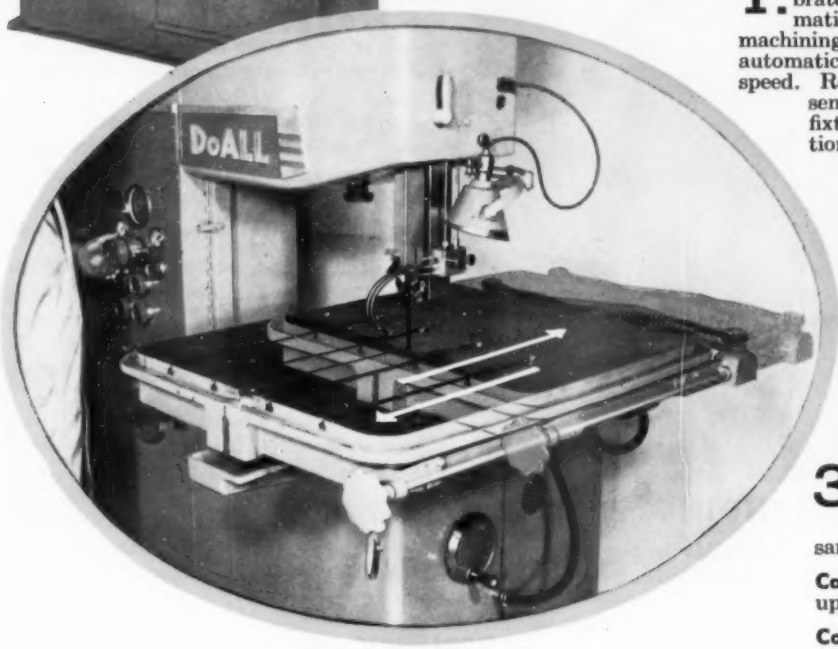
UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

RE-EVALUATE your BAND SAWING

SEE Contour-matic® MACHINES

Model 26-3
One of a complete series of Contour-matics



1. New Power Work Table with calibrated work fixture on the Contour-matic removes the labor from band machining. Smooth-operating controls automatically coordinate feed and tool speed. Result: band sawing becomes semiautomatic with little or no fixturing for toolroom or production runs.

2. New Cutting Tool is the high-speed steel Demon* saw band. Its phenomenal properties permit performance that is 30 times longer than ordinary carbon steel blades. Tooth sharpness is retained at high temperatures, thus permitting heavy feeds at higher tool velocities to give maximum cutting rates and tool life.

3. New Cutting Rates—up 650%.

Accuracy—held within thousandths.

Capacity—table feeds heavy work up to 1,000 lb.

Coolant—mist or flood for extended tool life at maximum sawing rates.

New Concepts of Band Machining Economy and Versatility

Contour-matic band machines are different. There is nothing else like them in the machining world. For machine tool replacements or additions, Contour-matics open new possibilities for the reducing of machining costs.

It is the choice of production personnel and methods engineers who have evaluated the band machining method. They find Contour-matics are their best machine tool investment.

Do what others are doing—question your band sawing and other machining methods by asking, "Can it be done on a Contour-matic?" Just call your local DoALL store for a free demonstration right in your own plant . . . or write.

B-56

FREE—"Job Spotting" Service

For your evaluation—illustrated case histories of job savings made by the Contour-matics over former methods will be mailed to you periodically. Send us your name on company letterhead.

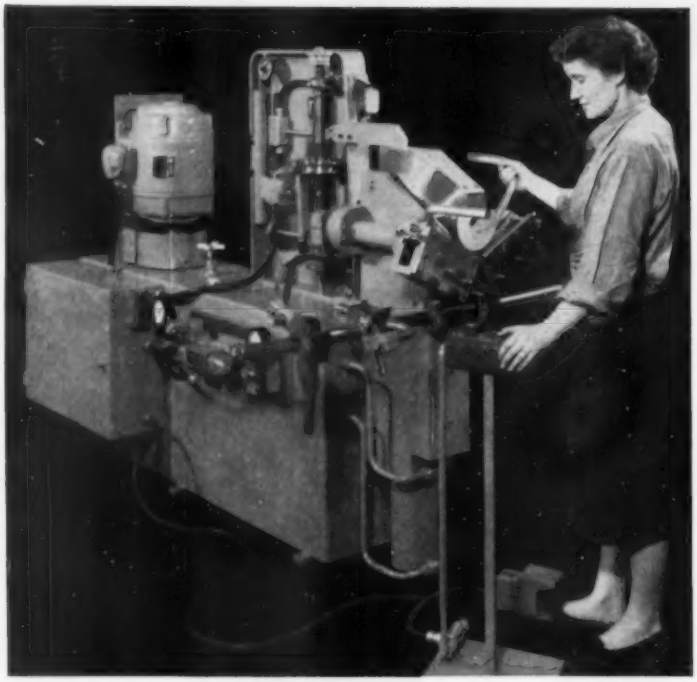
Reg. T. M. The DoALL Company

The DoALL Company, Des Plaines, Illinois

THIS IS A TYPICAL DoALL STORE

NEW PINES 3T PRESS

Cuts Bending Costs AS MUCH AS 50%



COMPLETE LINE OF BENDING PRESSES

In addition to the Model 3-T, Pines also builds the larger bending presses, illustrated below, which are also establishing outstanding performance records.

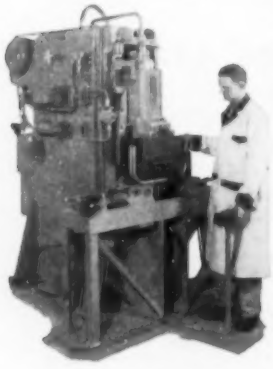
Makes Bends Progressively to Varied Angles In Multiple Planes 2 to 3 Times Faster

Quality bends at production speeds that are 2 to 3 times faster than conventional methods, are now possible with the new Pines 3-T Bending Press. Many tubular parts in sizes up to 1" O.D. are now formed at net speeds of over 1000 bends an hour. Up to 9 different bend angles can be produced in a single setup. Adjustable automatic indexing stops accurately control depth of ram stroke. Open tooling area permits rapid progressive bending in varied planes.

Wing Die Design Assures Quality Bends

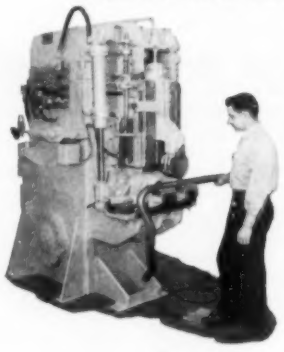
High production speed is just part of the story. Unusually smooth, good looking bends are produced to meet the quality demands of automotive, furniture, toy, office equipment, and appliance manufacturers. Wing dies of the press are designed to move in ways as a bend is made, and their pivoting action is hydraulically cushioned through bearing-mounted rocker arms. This principle eliminates scratches or draw marks and produces wrinkle-free bends with very little distortion. Get the complete story on cost cutting advantages of this new Bending Press today.

MODEL 6T FOR MULTIPLE U-FRAME BENDING



Makes two bends of the same or slightly different angles in each of two or more tubes simultaneously. Production of four or more bends with each stroke makes it possible to form 1700 to 3000 bends per hour in tube sizes ranging up to 1" O.D. x .065". When necessary, retractable ram dies are used to release pieces from die grooves. Like 3-T, wing dies move with work, eliminating draw marks, producing bends of superior quality.

MODEL 1900 FOR PROGRESSIVE BENDING OF TUBES UP TO 2" O.D.



Designed for high speed bending of parts requiring a variety of bends in different planes, such as automotive exhaust and tail-pipes, or similar work. Major features are automatic angle indexing and greater working clearance which permits completing, for example, 90% of all bends in a tail-pipe with a single tooling setup. Press handles stock sizes up to 2" O.D.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

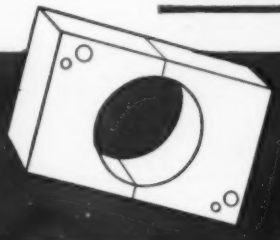
695 WALNUT • AURORA, ILLINOIS

WRITE FOR *FREE* DATA SHEETS

To keep abreast with bending, write for free copies of "Pines News"—get latest data on rotary and press-type machines, and up to date information on tooling.

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

HOW TREPANNING CUT MACHINING TIME 73.9%



Drilling compared with trepanning
Black Rock Shop Order #9278

Old method:	**Min.**
Pilot drill	3
Twist drill	20
Rough bore	25
	48
New method:	
Start groove	9
Trepan	3½
	12½*

*Rough boring not required

Saving—35½ minutes per piece

BLACK ROCK MFG. CO. TRIPLED PRODUCTION WHEN THEY CALLED IN THEIR MADISON MAN

Putting a hole in 4340 forged stock, 3½" deep and 5 13/16" diameter had been taking 48 minutes. This was too slow, rejects were too high.

Black Rock Mfg. Co. of Bridgeport, Conn., producers of Reed Prentice Milling Machines and Lathes as well as rubber cutting and grinding equipment, wondered if trepanning wasn't the answer . . . and called in their Madison Man, the man with the holes in his head.

Based on his recommendations, Black Rock turned to trepanning and produced the same hole in 12½ minutes floor-to-floor. Total tooling costs were less than $500. Production jumped to 5 pieces every 62½ minutes, rejects were cut in half.

Whether it's trepanning, deep-hole drilling, boring, reaming or any hole making or finishing operation . . . your Madison Man has the experience and tools to solve the problem.
CALL YOUR MADISON MAN NOW!

To be sure . . . be sure it's made by . .

MADISON INDUSTRIES, INC.

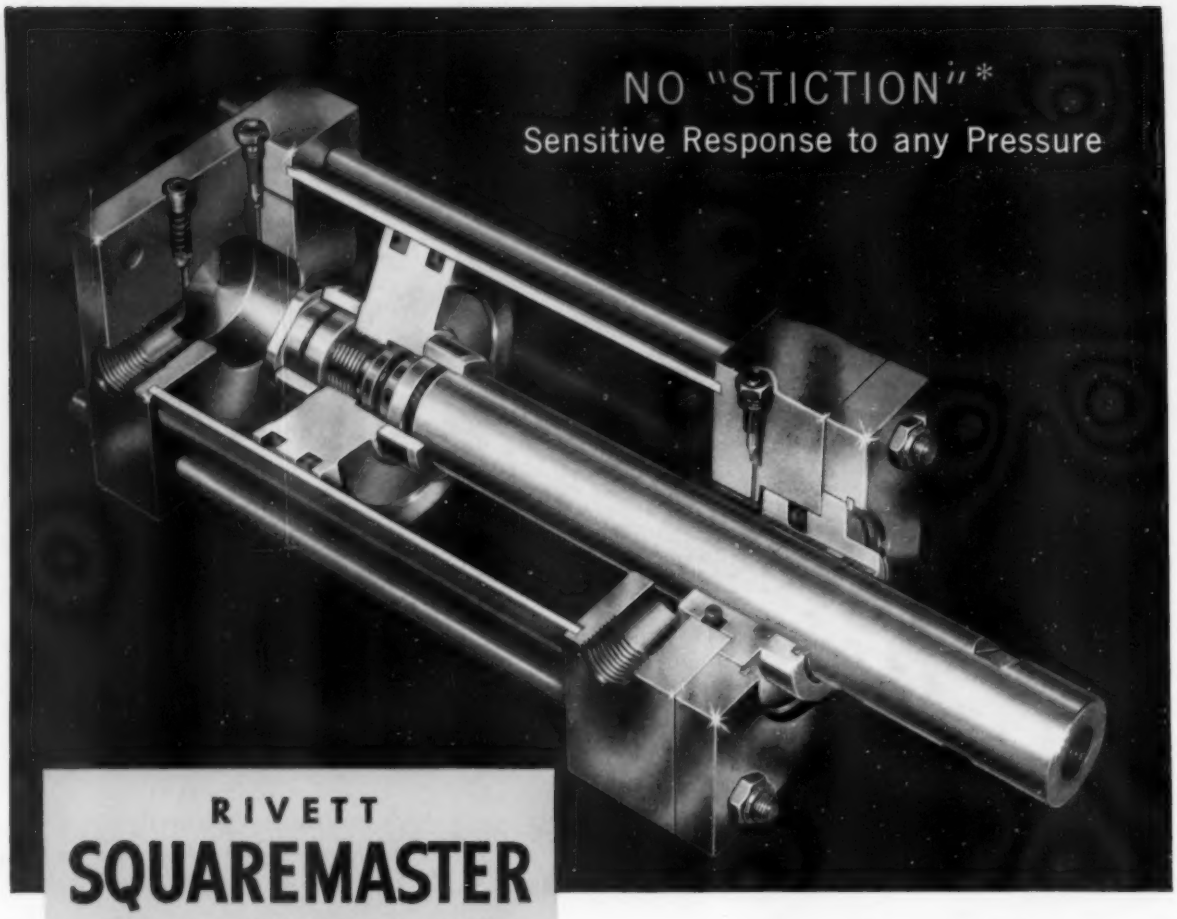
. . . first in inner diameters

DEPT. 215, PROVIDENCE, RHODE ISLAND

Associated with: Madison-Faessler Tool Co. • Madison-Relco Tool Co.

FREE!

Get your Madison Fact File on Trepanning. Please write on company letterhead.



RIVETT SQUAREMASTER "100" CYLINDERS

Unfailing POWER for MILLIONS of cycles!

Here's sure power for unfailing cylinder operation. SQUAREMASTER 100's are the world's finest constructed cylinders—perform with 100% efficiency! 200 P.S.I. air to 500 P.S.I. oil. Available in 7 mountings with standard dimensions, in 10 bore diameters, internal and external threading. Special models and cover combinations. Priced competitively; prompt delivery; meet all J.I.C. requirements.

RIVETT, INCORPORATED

Dept. TE-5, Brighton 35, Boston, Mass.

*Initial High Coefficient of Static Friction

POWER-PACKED FEATURES PROTECTED BY POWER-GUARD CONSTRUCTION

1. Piston rod. Ground and polished alloy steel. Hard chrome-plated. **2.** Piston rod bearing. Replaceable cartridge-type. **3.** Piston packing adjusts automatically. V-block packing minimizes friction. **4.** Correctly stressed tie rods. **5.** Cushion bushings. Bronze, floating type. **6.** Ports rotated to any 90° position. **7.** Steel covers. Take minimum mounting space.

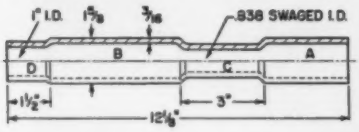
Send for catalog. Proof of SQUAREMASTER efficiency stated in these 20 pages. Write today.

RIVETT furnishes a complete power package

AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS

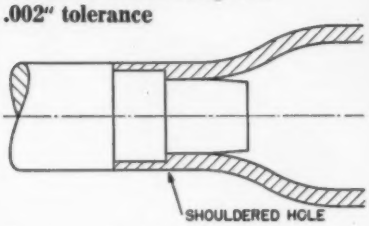
Member — National Fluid Power Association

Swaging lowers costs



To bore and recess cavities A and B to provide tool runout for broaches or taps is a costly operation. It is simply and quickly done on a Torrington Electro-Hydraulic Die Closing Rotary Swager. Section C is closed in by the wedge-operated die using a mandrel to hold ID tolerances. Rate: 240 per hour. Section D is swaged by conventional operation of the machine at 350 per hour. Swaging over a mandrel often eliminates further drilling or reaming operations.

Shouldered hole swaged to .002" tolerance



Copper or aluminum accumulator tubes often require a shouldered hole of two diameters to provide for assembly of a connecting tube. Both diameters can be held to .002" by swaging over a shouldered mandrel. Swaging eliminates a drilling operation and produces a smoother and more accurate hole. Production rate on 1" tubes with 20° inc. angle is as high as 240 per hour.

Swaging forms long threads

Rotary swaging can conveniently thread long lengths. For example, the Model 211 Torrington Swager, running at 570 rpm on 32 pitch thread would turn out about 18 inches per minute with no chips. Swaging produces Class 2 threads, with one thread every spindle revolution.

Can ALL these parts be swaged?

YES—versatile swaging is faster and more economical!

These and many other operations can be done faster, more economically on a Torrington Rotary Swaging Machine—pointing, tapering, reducing, sizing, forming inside contours. Because swaging moves metal, many parts can be swaged in less time, using less materials without turning a chip. Applications of swaging are being extended daily by Torrington to answer production problems—saving money, improving tolerances and finish. Your Torrington engineer can show you new ways to swage many parts you are now machining. Make a note today to call him. The Torrington Company, Swaging Machine Division, North Street, Torrington, Conn.

Visit Torrington. Design Engineering Show
Philadelphia • May 25-28

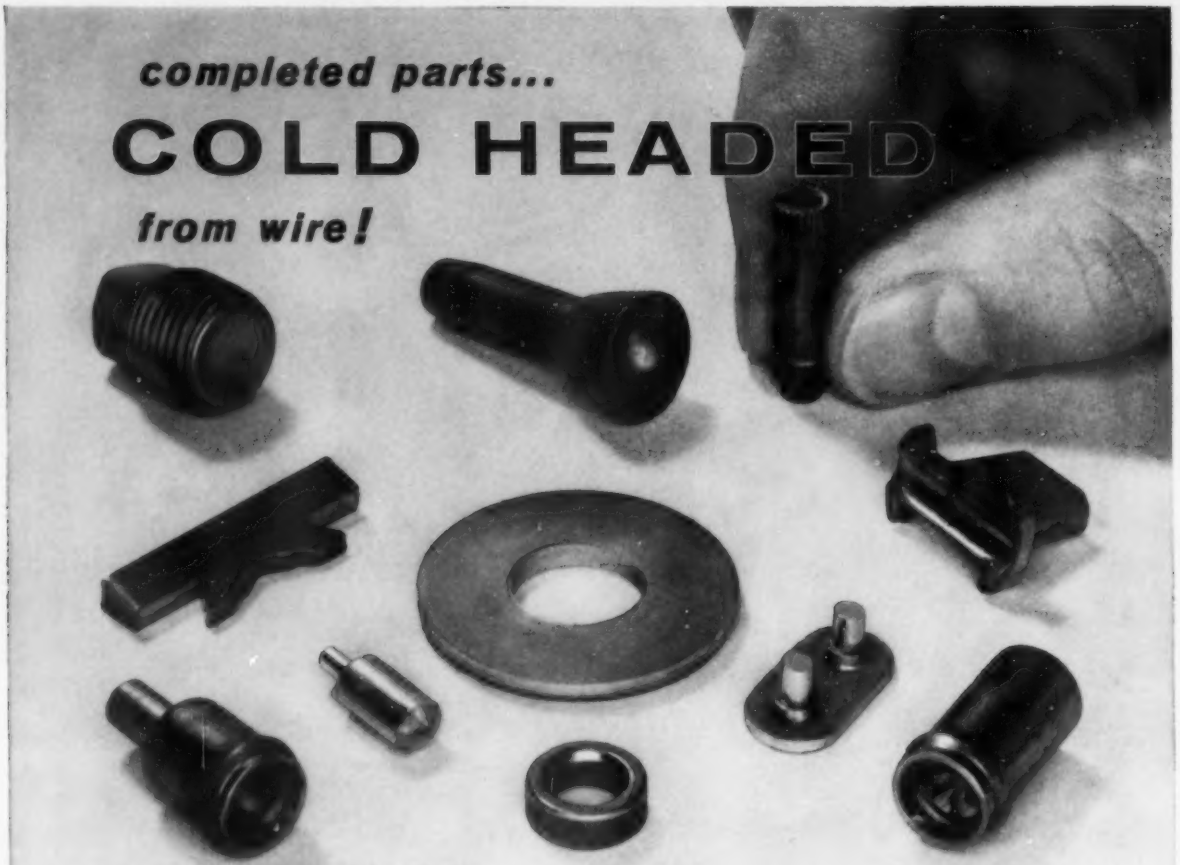
TORRINGTON ROTARY SWAGING

USE READER SERVICE CARD; INDICATE A-5-175

completed parts...

COLD HEADED

from wire!



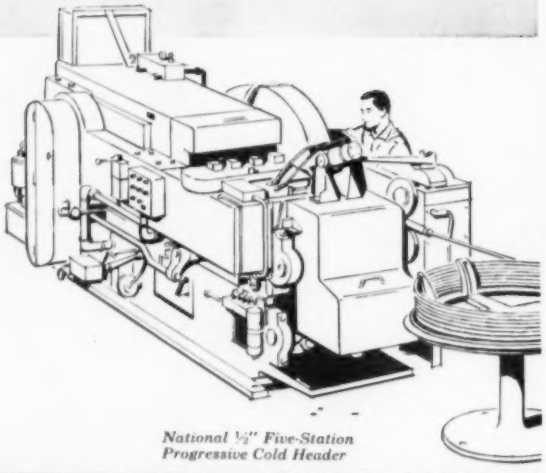
Top row, left to right: pipe plug, ball seat for push-rod end, splined square-head shaft. Middle row: commutator bar, solenoid contact, wire clamp. Bottom row: distributor cap insert, transistor case, spacer, link, distributor cap center wire insert.

All of the odd-shaped metal parts above were developed for fast, accurate production on National Cold Headers.

Complete and ready to use, these parts are made from wire, start-to-finish in one compact machine, at unbelievably high speeds with excellent die life, in most cases with no loss of material!

Production ranges from 40 parts per minute with stock of 1½" diameter up to 450 per minute in the ⅛" size. The jobs illustrated average 161 per minute.

Have you investigated Cold Heading? If you now have headers, have you considered widening your range and type of work to meet the growing requirements of metalworking?



National ½" Five-Station Progressive Cold Header

Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS

NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

HARTFORD DETROIT CHICAGO

A PRODUCT OF SKILL

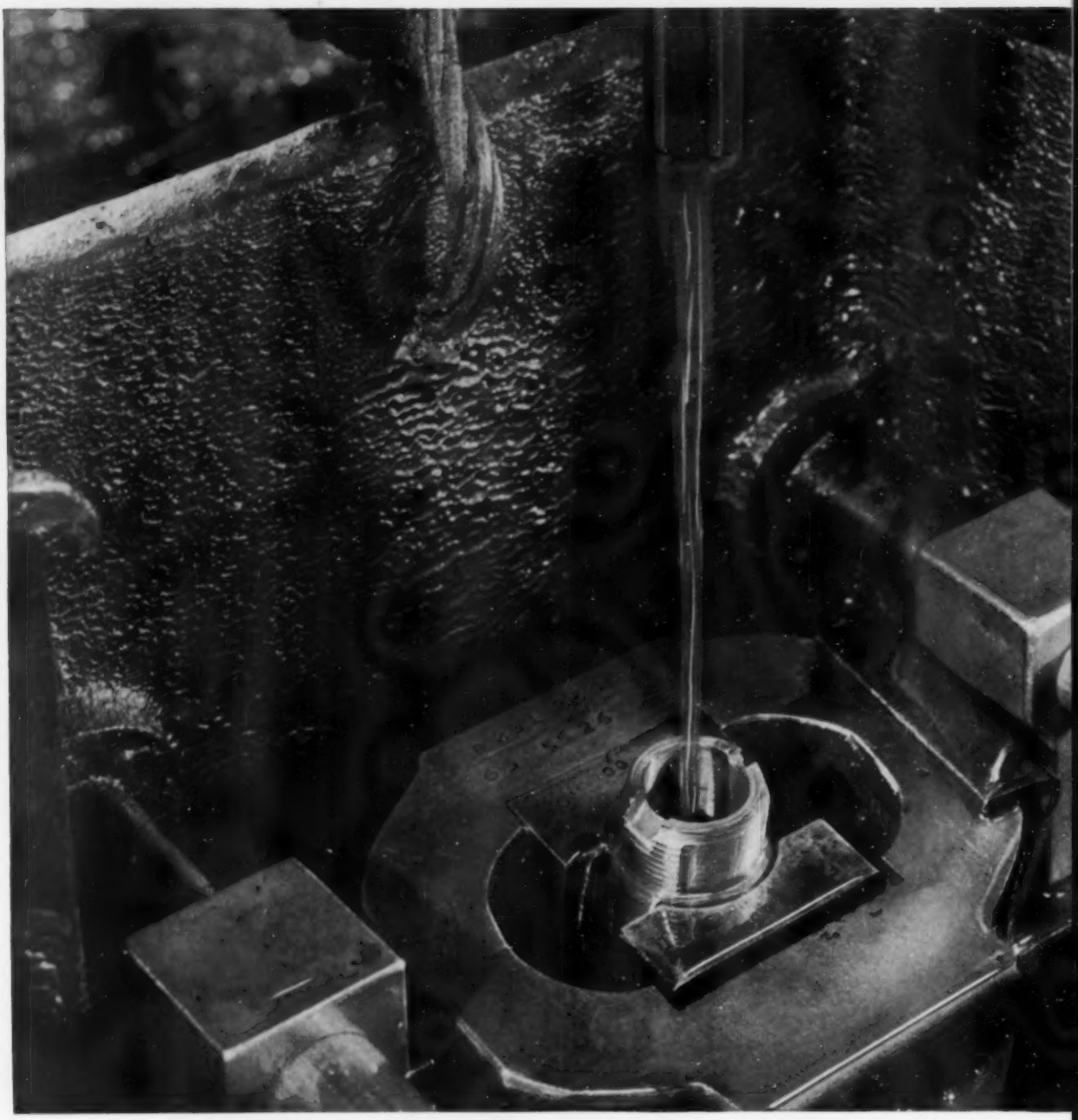
BUTTERFIELD
100%
INSPECTED
TOOLS

the complete line

Expertly-made Butterfield end mills, reamers, drills, taps, dies, counterbores, cutters, hobs and carbide tools are quickly available wherever you are located. Warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York and San Francisco. **Call your Butterfield Distributor.**

BUTTERFIELD

BUTTERFIELD DIVISION, UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT



Gulfcut 11A chosen for precision work and fine finishes at

GULF MAKES THINGS

Ithaca Gun Company, Inc., of Ithaca, N. Y., makes the famous Model 37 Featherlight Repeater, Model 37 Rib Grade Repeater and Model 37R DeLuxe Repeater . . . all shotguns to warm the heart of any hunter.

Special steel barrels for these guns are reamed on a 12-spindle machine designed and built by Ithaca Gun engineers. Each gun barrel passes through three borings of different sizes before the proper size choke is achieved. Chokes from .410 gauge to 10 gauge are obtained on this machine, which can bore 80 barrels per hour.

Says A. G. Stevens, Plant Superintendent: "Our gun barrels are reamed to very close tolerances, and they must have a silk-smooth finish. When you're doing precision work like this, cutting oils play a mighty impor-

Shotgun barrel boring machine, designed and built by Ithaca Gun engineers, has 12 spindles on each side. Machine can bore 80 barrels per hour with both sides running.

A. G. Stevens, Plant Superintendent, inspects a Model 37 Featherlight Repeater. Gulfcut cutting oil helps Ithaca Gun maintain the close tolerances essential for accurate-firearms.

Gun barrel is pushed up onto stationary reamer of special boring machine. Gulfcut 11A pours continuously over the boring area and is re-circulated through a filter system.

Ithaca Gun Company . . .

RUN BETTER!

tant part. We've experimented with many different oils, but for our purposes Gulfcut 11A is the best of all."

See how Gulf makes things run better in *your* operation. Whatever type of machining you do, you'll find exactly the right cutting oil in the complete Gulfcut line. Send now for illustrated Gulfcut bulletins, or contact your nearest Gulf office.

GULF

GULF OIL CORPORATION
Dept. DM, Gulf Bldg., Pittsburgh 30, Pa.
Send me more information on:
☐ Gulfcut "Regular" Cutting Oils
☐ Gulfcut Heavy Duty Soluble Oils

Name _____
Company _____
Address _____
City _____ Zone ____ State _____

TX-0129

The DoALL Band Tool Guarantee

Every DoALL Band Tool is unconditionally guaranteed to meet all current published specifications, including set tolerances, and to be completely free of defects in material, workmanship, heat-treating and packaging. Any band not meeting these specifications will be replaced free of charge provided the defective band is returned, prepaid, to DoALL.

SB-70¼

Danny DoALL says:

"Only DoALL gives this guarantee for its saw bands in writing!"

83 separate inspections — from raw stock to finished saw bands and uniform tooth set within ±.002" — make this guarantee exclusive. TRY THEM TODAY . . . realize the profitable difference.

Find Your DoALL STORE In The "Yellow Pages"

Call — your local DoALL STORE

THE DoALL COMPANY

DES PLAINES, ILLINOIS

USE READER SERVICE CARD; INDICATE A-5-180-1

TO BE SURE OF *QUALITY*

Remember the Name

STEEL STAMPS

HOGGSON

MARKING DEVICE SPECIALISTS

These letters and figures are deep-cut in hardened, special-formula steel. This insures clean, sharp impressions and long service. Well balanced, easy to use. At your mill supply. Write for circulars.

ALSO IN REVERSE FOR MOLDS & DIES

Hoggson & Pettis Mfg. Co., 141 Brewery St., New Haven 7, Conn.

USE READER SERVICE CARD; INDICATE A-5-180-2

are you GEARED for COMPETITION?

SYKES VERTICAL GEAR GENERATOR

MODEL V10A

FEATURES: Automatic or manual infeed can be selected at will with this high production gear generating machine.

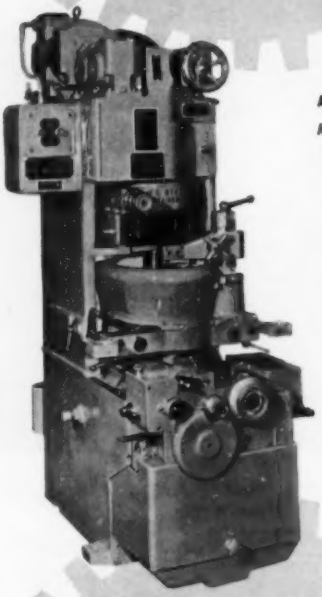
WORK CAPACITY: The work capacity extends from the smallest gears and splines to the maximum sizes shown below. The maximum work center to table distance of 11½" enables gears mounted on long shafts to be accommodated.

CUTTING SPEEDS: Cutting speeds of 149, 186, 224, 280, 330, 413, 498 and 622 strokes per minute are provided by a pulley system operating from a 2-speed 2 H.P. motor. There is an alternative range of slower speeds. Also available with variable speeds and feeds.

SPECIFICATIONS FOR SPUR AND HELICAL GEARS:

EXTERNAL GEARS— maximum dia. with 3" P.C.D. cutter 14".
INTERNAL GEARS — maximum internal dia. with 3" P.C.D. cutter (manual infeed) 20". (automatic infeed) 6½".
MAXIMUM FACE WIDTH ———— 2¼"*
MAXIMUM HELIX ANGLE —— 45 Deg.
PITCHES — 5 to 64 D.P.*

* Dependent upon the gear diameter



ATTACHMENTS:

A rack generating attachment is available for the production of racks and other profiles from flat section stock. Contrate gears may be accurately and economically cut with the aid of a special attachment designed to suit the Model V10A.

Installations of all Sykes Machines are supervised by our own factory trained engineers and carry a one year service guarantee.

SYKES

For Detailed Information and Specifications, Write to:

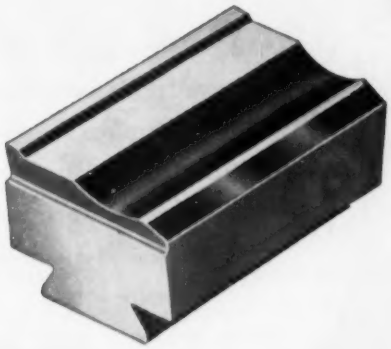
SYKES MACHINE & GEAR CORP.

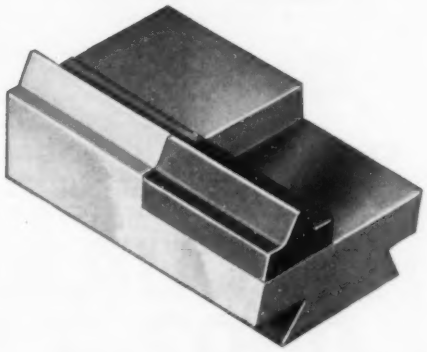
744 BROAD STREET • NEWARK 2, NEW JERSEY
Telephone: MArket 3-3290 • Cable: Sykus Newark

USE READER SERVICE CARD; INDICATE A-5-180-3

USE READER SERVICE CARD; INDICATE A-5-181

Everybody knows that
National Tool Company
makes all types of
high-speed form tools—





But did you know
we make all types
of carbide-tipped
form tools . . .

and more special cutting tools of all kinds
than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools call your National Tool representative. His assistance is yours for the asking whether you're interested in one *special* tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

Representatives in major industrial centers

New FREE Catalog

To National Tool Co., 11200 Madison Ave., Cleveland, Ohio

Please send NEW 92 page catalog showing National Tool Company's complete line of *special* tools for the metal-working industry.

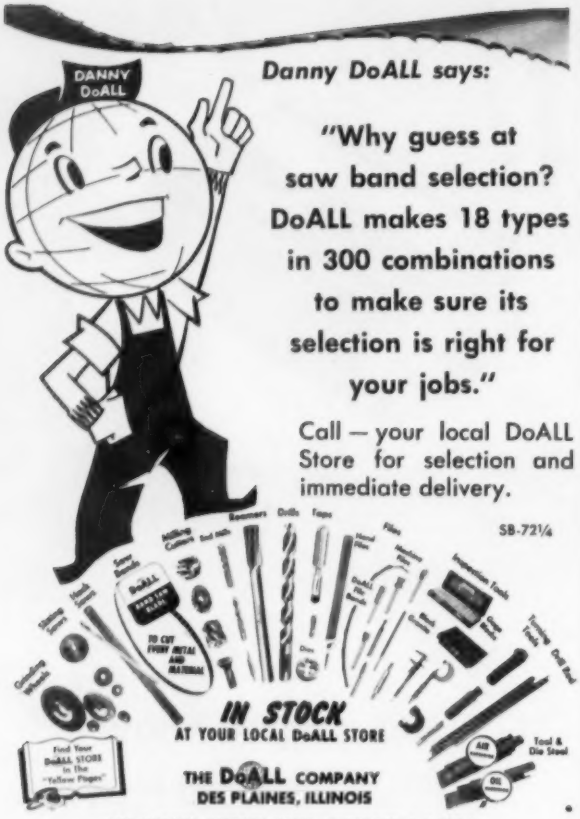
Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____


DANNY DoALL
Danny DoALL says:
"Why guess at saw band selection? DoALL makes 18 types in 300 combinations to make sure its selection is right for your jobs."
Call — your local DoALL Store for selection and immediate delivery.
SB-72¼
IN STOCK
AT YOUR LOCAL DoALL STORE
THE DoALL COMPANY
DES PLAINES, ILLINOIS

USE READER SERVICE CARD; INDICATE A-5-182-1

CERROTECHNICS

expedites

many time-consuming industrial tasks

CERROTECHNICS encompasses various methods of employing CERRO* ALLOYS (bismuth • lead • tin • cadmium) to shortcut many laborious industrial operations. These procedures can save valuable time and lower costs in:

- Anchoring stationary machine parts
- Bending thin-walled tubing
- Electroforming molds
- Holding permanent magnets
- Making chuck jaws—molds for plastics
- Reclaiming cracked dies
- Securing punches and dies
- Reproducing master patterns

And 55 other jobs you can do better, in *minutes* instead of *hours*, using CERROTECHNICS.

Find out how low-temperature-melting CERRO ALLOYS can help you . . . send for our new "HOW TO" booklet, No. J4, which illustrates and lists all 63 useful and cost-saving applications.

*T. M. Cerro de Pasco Corporation.

CERRO DE PASCO SALES CORPORATION
Room 1503, 300 Park Avenue, New York 22, N. Y.

USE READER SERVICE CARD; INDICATE A-5-182-3

Modernair

VIH (VALVE-IN-HEAD) CYLINDERS

Save Space, Weight & Piping

NO SEPARATE VALVES TO MOUNT OR PIPE . . . Modernair's VIH cylinders have directional and exhaust speed control valves built in!

FEATURES:

*COMPACT CYLINDER-VALVE "PACKAGE" includes built-in directional control, exhaust speed control valves.

*SOLENOID, BUTTON BLEEDER or PILOT PRESSURE valve operation.

*INTERCHANGEABLE MOUNTINGS.

BRIEF SPECIFICATIONS:

DIAMETERS: 1½", 2", 3" ROD SIZES: ½", ⅝", ¾"
MIN. OPERATING PRESSURE: 20 p.s.i.
MAX. OPERATING PRESSURE: 150 p.s.i. (solenoid)
200 p.s.i. (bleeder or pilot pres.)

Write for catalog, prices today—or phone your local MODERNAIR distributor (listed on your phone book Yellow Pages).

Modernair CORPORATION

Dept. H-5, 400 PREDA STREET, SAN LEANDRO, CALIF.
5007 Brookpark Rd., Cleveland 34, Ohio 38

USE READER SERVICE CARD; INDICATE A-5-182-2

ACCURACY .0002 T.I.R.

.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

Clip ad to your letterhead and send for Literature

K. O. Lee Company, Aberdeen, S. D.

USE READER SERVICE CARD; INDICATE A-5-182-4

MOLYKOTE®

LUBRICANT

metalworking news

PUNCH LIFE INCREASED FROM 2,000 to 25,000 HOLES IN STEEL PLATE

These punches (11/16") were used to punch 25000 holes in ½", 1020 cold rolled steel plate. Without MOLYKOTE Lubricants a maximum life of only 2000 holes could be obtained.

A West Coast manufacturer was experiencing low punch life with the best conventional lubricants. Their multiple punching operation consisted of cold shearing 50 holes simultaneously in a single steel plate. A maximum life of 2,000 holes per punch was obtained with ordinary lubricants.

Then, MOLYKOTE Type G was applied to the punch occasionally. The result: punch life was increased from 2,000 to 25,000 holes which afforded substantial savings.

When writing, refer to Item 508

"A LITTLE BOTTLE FOR A BIG JOB"

- For Extending Die Life.
- For Preventing Metal Pickup.

Try it . . . Order a 10 ounce container of MOLYKOTE Type Z TODAY!

When writing, refer to Item 507

MOLYKOTE CANNOT BE SQUEEZED OUT REGARDLESS OF PRESSURES; EXCELS AS COLD-FORMING LUBRICANT IN METALWORKING

Distortion, Stick-Slip and Fretting Eliminated • Mounting Loads Reduced • Chatter and Noise Avoided • Allows Easier Disassembly

In metal forming the most difficult problem to overcome is scuffing from metal pickup on the dies. Direct contact of bare surfaces of a piece undergoing formation with the die often results in galling, scuffing, etc. If the surfaces can be separated by a lubricant of sufficient film strength, metal pickup does not occur.

Before new dies are used, burnish them with MOLYKOTE Type Z. If the lubricant you are now using does not have sufficient film strength and galling does occur, use MOLYKOTE on your dies.

The automobile industry which forms and fabricates vast tonnages of various metals, uses MOLYKOTE Type Z extensively.

When writing, refer to Item 505

Applying MOLYKOTE Lubricant to feed stock at the Bassick Company, Bridgeport, Conn., in a forming operation.

DAMAGE DUE TO IMPROPER MACHINERY "WEAR-IN" CAN BE ELIMINATED WITH NEW COMPOUND

Wear-in damage is often serious enough to require costly reconditioning of new equipment and if the damage is not repaired, it will interfere with and reduce the useful service life of expensive machinery. During this critical wear-in period, damage due to galling, scoring, tearing, scratching, excessive abrasion and seizing is an inherent hazard. MOLYKOTE WEAR-IN COMPOUND is the most effective lubricant yet developed to combat this damage.

In seven different ways, MOLYKOTE WEAR-IN COMPOUND saves you time and money:

1. **Shortens "wear-in" period without use of abrasives.**
2. **Reduces galling, seizing and excessive wear during the critical "wear-in" period in new or rebuilt machinery and after the installation of replacement parts.**
3. **Offers the best safeguard against costly reconditioning work and shipping delays due to the "breaking-in" of new machinery.**
4. **Eliminates "stick-slip" behavior and resists galling and seizing at bearing pressures far beyond the yield point of any metal.**
5. **Specifically designed for "wear-in" use. MoS_2 particles make intimate contact with bearing surfaces. Will not scrape off.**
6. **Need not be burnished into surface. Brush or wipe on a thin coating.**
7. **Inexpensive . . . a little goes a long way.**

When writing, refer to Item 506

Address your letter to The Alpha-Molykote Corp., 65 Harvard Ave., Stamford, Conn.
Phone: FIreside 8-3724.

SEE OUR CATALOG IN SWEET'S

THE ALPHA-MOLYKOTE CORP.
Stamford, Connecticut
Please send me details on

Item 505 ☐ **Item 506** ☐ **Item 507** ☐ **Item 508** ☐

Name .....
Company .....
Address .....
City .....
State .....

THE ALPHA-MOLYKOTE CORPORATION

BREAKING LUBRICATION BARRIERS

. . . THROUGH RESEARCH

Danny DoALL says:

"For Complete SERVICING of Demon® SAW BANDS

Call your local DoALL STORE!"

Experts specialize in guaranteeing new life for your usable Demon bands by reconditioning, resharpening and inspection . . . and their weld perfection assures 3½ times longer flex life. Also complete stocks of new blades.

THE DoALL COMPANY
DES PLAINES, ILLINOIS

USE READER SERVICE CARD; INDICATE A-5-184-1

USE THIS NEW KIND OF DIAMOND CUT-OFF WHEEL

Gives narrower, smoother cuts on industry's toughest materials

. . . yet prices start at only $32.25

Now . . . at *production prices* . . . DIATRONIC gives you a rim width of .006" that's accurate to a maximum total tolerance of .0005"—or your money back. This accuracy is built in by a new process. No break-in needed. New narrow cut reduces sawdust loss 30%. A must for $3,000-a-pound silicon or germanium crystal. Cuts tungsten carbide, corundum, aluminum oxide, glass . . . practically anything. Stock orders shipped in hours; special wheels available. Write for literature, price list.

Another invention marketed by
NAVAN PRODUCTS, INC.
Subsidiary of North American Aviation, Inc.

Dept. 202, International Airport, Los Angeles 45, Cal.

DIATRONIC® DIAMOND WHEELS
"with built-in tolerance" ®TRADEMARK

USE READER SERVICE CARD; INDICATE A-5-184-3

immediate delivery ....

TAPERLOCK PLUG GAGE HANDLES and BLANKS

(Made to American Gage Design Standards)

Here's the latest modern, quick, and most inexpensive way to make top quality plug gages.

It's as easy as one, two, three. One: select already hardened Tool Steel Gage Blank closest to your finished dimension. Two: select corresponding Gage Handle. Three: grind and lap to tolerance. It's as simple as that. Each part is absolutely guaranteed to meet the most rigid American Gage Design Standards.

WRITE TODAY FOR FREE PRICE CATALOG

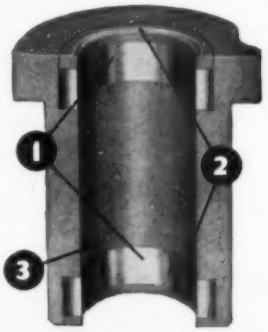
HURON MACHINE PRODUCTS INC

HOME OFFICE	EAST COAST BRANCH	WEST COAST BRANCH
P. O. Box 2274	P. O. BOX 208	P. O. BOX 25
DEARBORN, MICHIGAN	WEST HARTFORD, CONN.	BURBANK, CALIFORNIA
LOgan 5-0400	ADams 3-7621	Victoria 9-5013

USE READER SERVICE CARD; INDICATE A-5-184-2

CARBIDE INSERTED MEYCO BUSHINGS Can Cut Production Costs!

MEYCO carbide inserted drill jig bushings have been successfully saving money on production runs for the past decade. Performance: same as solid carbide, but need not be handled with kid gloves. Greater economy, because of long life at less cost. You can enjoy the advantages of greater accuracy for a longer time, less spoilage, less machine down-time, added drill and jig life with MEYCO carbide inserted drill jig bushings. Get the full story now: write for new Bushing Catalog No. 42

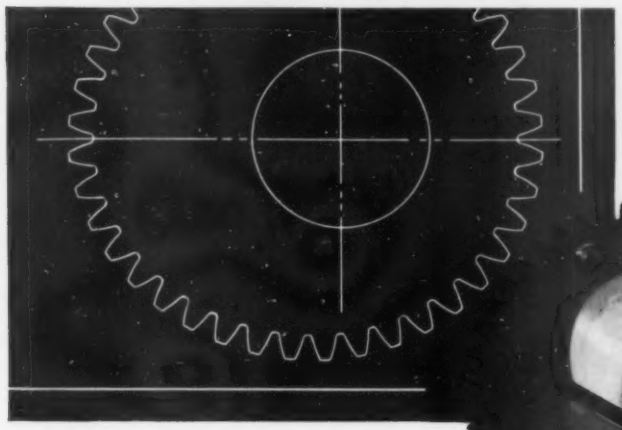


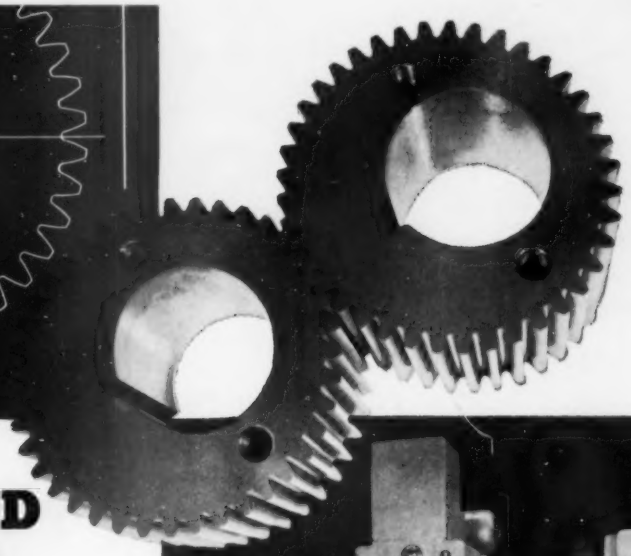
***PATENTED**

1. Tungsten carbide rings at the points of wear; **2.** Steel rings protect drills and carbide; **3.** Special hardened alloy steel body.

W. F. MEYERS CO., INC., BEDFORD, IND.

USE READER SERVICE CARD; INDICATE A-5-184-4



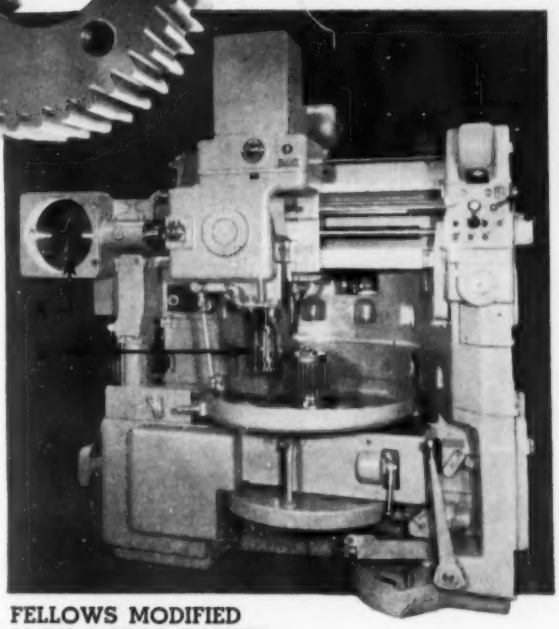


ELLIPTICAL AND OVAL GEARS

produced accurately and economically

Until now, owing to production difficulties, the design advantages of oval or elliptical gears have rarely been realized. Now Fellows has developed a unique method of generating these gears rapidly and economically. This new method minimizes the difficulty of wide variations in backlash experienced with such gears cut by previous methods. Full or modified involute teeth are produced to a higher degree of accuracy than was ever possible before on gears of this type. Production in any quantity is as simple as in cutting conventional cylindrical gears, once the setup has been made.

Fellows Modified 36-Type Gear Shaper generates elliptical or oval gears by continuously varying the center distance between cutter and gear during the cutting operation. A contour cam (A) and follower move the saddle the required amount in timed relationship with the rotation of the eccentric cutter-spindle adapter (B) to produce the gear pitch line contour.



FELLOWS MODIFIED 36-TYPE GEAR SHAPER

In addition to *oval and elliptical gears* up to a maximum pitch diameter of 18", the Modified Fellows 36-Type Gear Shaper can produce a remarkable variety of *irregular contours* at high production rates. Two cams, a cutter-spindle adapter and a cutter are required for each gear or other shape specification. For further information, get in touch with any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE

Fellows *Gear Production Equipment*

Danny DoALL says:

"Do you know that DoALL's Sawing Research Laboratory will help you solve unusual band-sawing problems?"

SB-76¼

Find Your DoALL STORE In The "Yellow Pages"

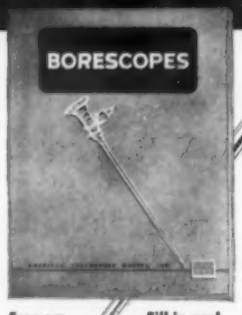
Problem materials? Difficult cuts? High costs? Get the answers FREE! Call your local DoALL store.

THE DoALL COMPANY
DES PLAINES, ILLINOIS

USE READER SERVICE CARD; INDICATE A-5-186-1

INSPECTION PROBLEMS?

This booklet is for you!



Free on request

Fill in and mail today

This comprehensive, elaborately illustrated booklet provides practical information on the use of the famous A. C. M. I. Borescope in various industries, for the inspection of interior areas or surfaces not otherwise visible—together with full data on the types of Borescope available, and on their care and maintenance. Have you received your copy?

To *American Cystoscope Makers, Inc.*
8 PELHAM PARKWAY PELHAM MANOR, N. Y.

Gentlemen: Please send me without obligation a copy of your booklet on Borescopes.

Name_____

Firm_____

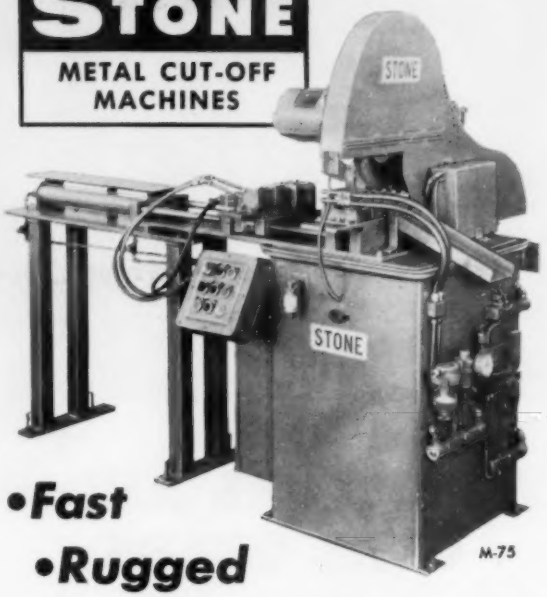
Address_____

City_____ State_____

USE READER SERVICE CARD; INDICATE A-5-186-2

STONE

METAL CUT-OFF MACHINES



M-75

•Fast •Rugged •Economical •Accurate

Designed for close tolerance cutting of ferrous and non-ferrous metals and non-metallic materials.

M-75 (Automatic) above – Fully automatic cut-off machine with stock bar feed. Fast, electropneumatic operated feed combined with power stroke for full automatic production cutting. Powered by 7½ H.P. continuous duty motor.

M-120 (Manual) – Rugged, heavy duty chop stroke machine, powered with full 10 H.P. geared-in-head motor. Features fast acting, large capacity, self-centering vise and heavy cast table machined for use with jigs and fixtures.

M-120

M-35

M-35 (Manual) – Minimum cost with maximum performance. These machines are precision engineered, and of cast construction to assure trouble free operation.

There's a Stone Cut-Off Machine to meet your every need. The many Stone exclusive features mean dependable performance in operation.

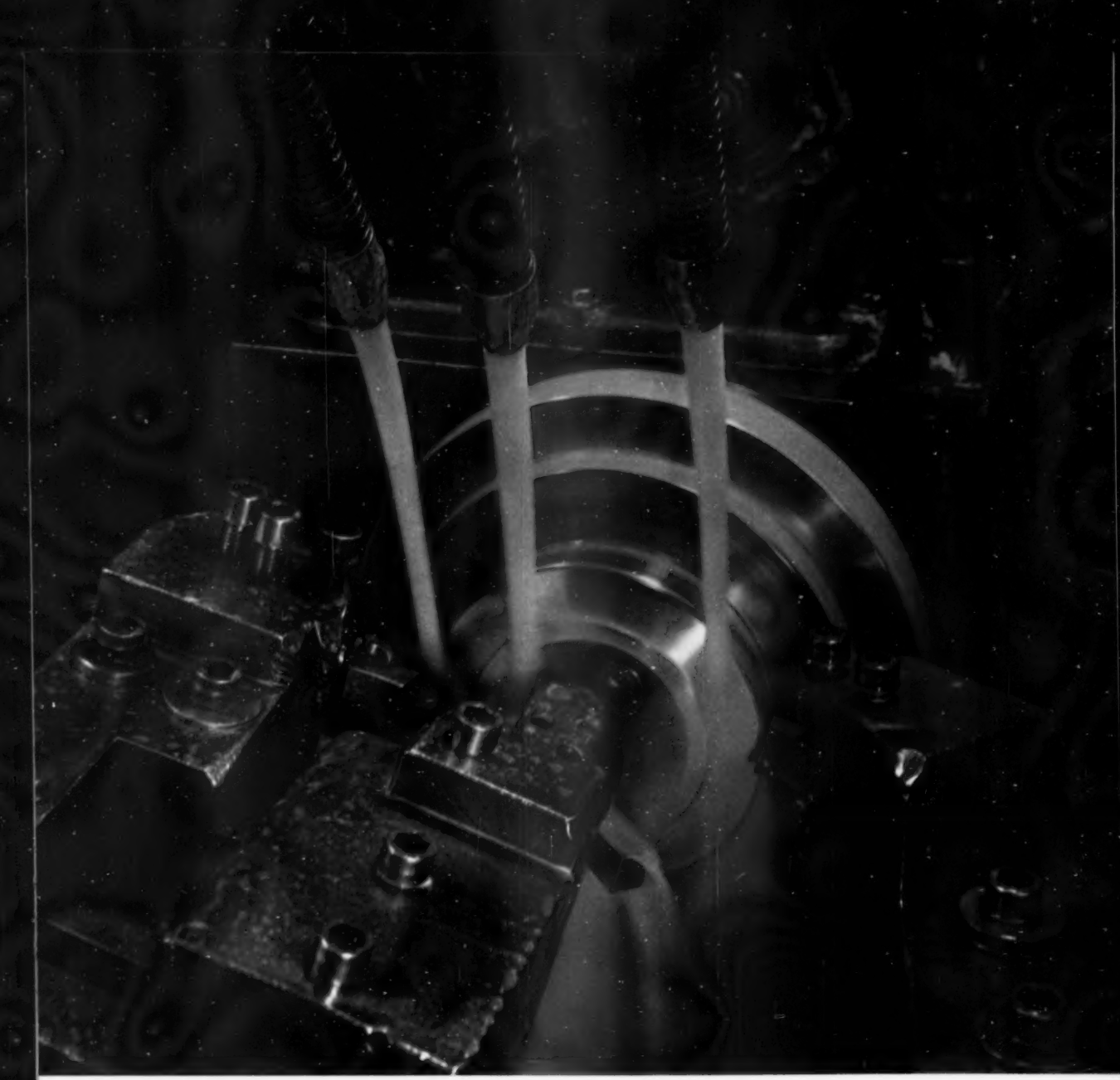
SEND FOR **FREE FOLDER** Illustrating Complete Line *Write Today*

STONE MACHINERY CO., INC.
31 Fayette St. Manlius, N. Y.

". . . represented in every major industry throughout the world."

USE READER SERVICE CARD; INDICATE A-5-186-3

USE READER SERVICE CARD; INDICATE A-5-187



Improved *Lusol* the coolest coolant of them all

Improved Lusol, an oil-free, transparent, water soluble solution, has the highest heat-removing capacity of all coolants, regardless of type.

This means cooler work pieces and cooler tools; makes possible increased speeds, increased feeds, increased accuracy, better finish and *greatly increased tool life.* Summing it up, Lusol means better production at lower cost.

But this is not all—Lusol, an oil-free solution, means cleaner machines and a cleaner plant. It eliminates smell and smoke. It is bland to the hands and cuts out dermatitis. Operators certainly appreciate it. As one said, "I feel as if I were in a new plant—no smell, no smoke, no slippery oily floors—and my wife likes me better when I come home."

Proved for years in hundreds of plants from coast to coast, Lusol is worth investigating NOW. Send for our 16-page illustrated catalog today, describing Lusol and the other Anderson metalworking products.

ANDERSON
OIL and CHEMICAL COMPANY, INC.

BOX 305, PORTLAND, CONNECTICUT

DISTRIBUTORS AND WAREHOUSE STOCKS COAST TO COAST

BETTER PRODUCTS FOR BETTER METALWORKING

SPS RELIABILITY | *A dynamic standard of predictable performance*

RECOMMENDED SOCKET SET SCREW TIGHTENING TORQUES

Screw Size	Unbrako (in.-lb.)	Set Screw B (in.-lb.)	Set Screw C (in.-lb.)	Minimum Differential %
#4	5	3.9	3.5	28
#5	9	7.8	7.4	15
#6	9	7.8	7.4	15
#8	20	14.7	14.5	36
#10	33	26.5	25	25
¼	87	62	60	40
5/16	165	122	125	32
⅜	290	198	225	29
7/16	430	309	350	23
½	620	460	500	24
5/8	1225	1106	1060	11
¾	2125	1540	1800	18
⅞	5000	3660	4600	9
1	7000	5025	6500	8

High torque UNBRAKO socket sets are available as follows: Sizes, #0 through 1 in.; materials, alloy steel and 18-8 stainless steel; Types, plain cup point (microsizes and stainless)—self-locking with knurled cup point (#4 through 1 in.)—self-locking with Nylok (plain cup point).

High Torque UNBRAKO socket set screws have up to 40% more holding power

Holding power—a vital factor in the selection and application of a set screw—is the result of the seating force developed by tightening the screw. Invariably the tighter a screw is wrenched into place, the greater will be the holding power. Recommended seating torques for High Torque UNBRAKO socket set screws are up to 40% higher than those for ordinary socket set screws. And the cup point, knurled counterclockwise, resists their backing out under vibration.

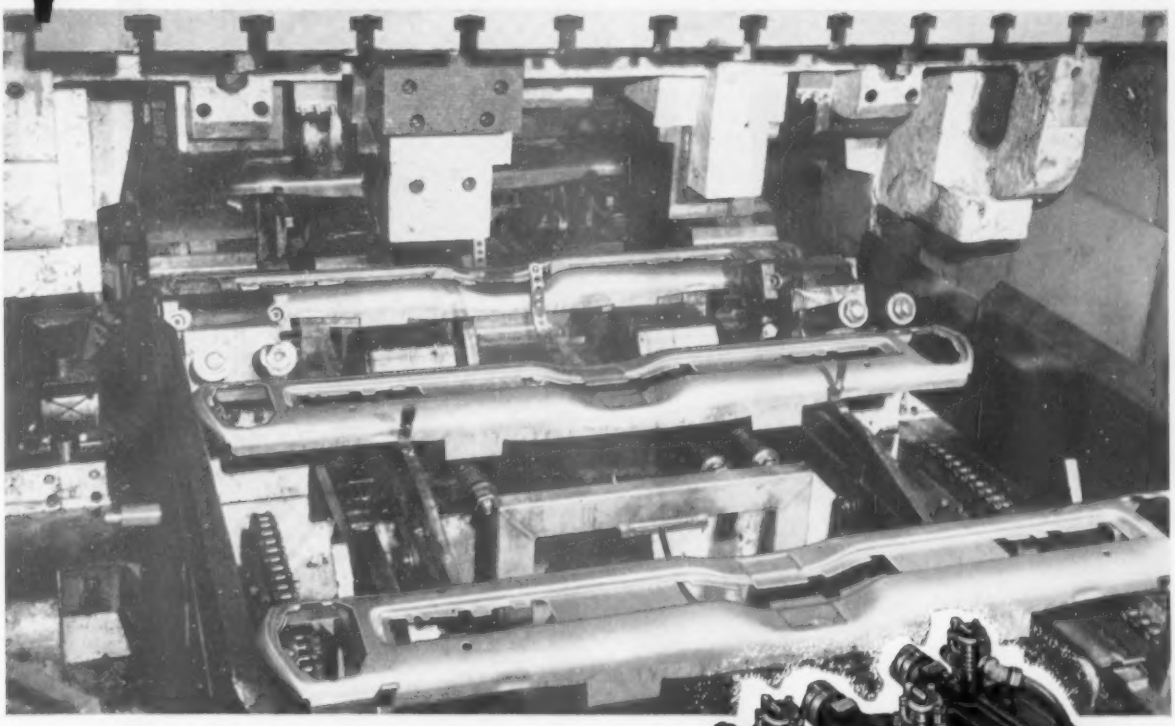
In addition to greater holding power, dimensional accuracy of length and OD, with consistent physical and mechanical properties from lot to lot, makes high torque UNBRAKO socket screws ideal for automation. Major diameters are held strictly to Class 3A thread tolerance to permit automatic feeding without jam-up. Socket depth and size are highly uniform to permit the driver to engage the socket in a split second and drive the screw home with speed and precision. Threads are fully formed to Class 3A fit to make the whole screw stronger and provide accurate mating. Heat treatment, in atmosphere controlled furnaces, prevents decarburization and provides hardness and strength for long wear.

High torque UNBRAKO socket set screws are stocked by authorized SPS industrial distributors. Ask the one nearest you for complete details. Or write SPS—manufacturer of precision threaded industrial fasteners and allied products in many metals, including titanium. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

SPS **Jenkintown • Pennsylvania**

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co. • National Machine Products Co. • Nutt-Shel Co. • SPS Western • Standco Canada Ltd. • Unbrako Socket Screw Co., Ltd.

Valvair® deceleration manifolds provide safe, velvet-smooth control of high-speed press transfer shuttles



This press transfer indexes 26 in. per cycle, at a 1,000 cycle/hr. rate. Valvair's compact, 3-valve deceleration manifold controls its horizontal movement . . . requires minimum mounting space . . . simplifies piping and wiring.

Performance of Valvair deceleration manifolds on press transfers maintains a steady high rate of production through a major automotive manufacturer's fully-automated 5-press stamping line. Valvair design assures necessary rapid movement of the transfer mechanism, with precisely controlled deceleration of the 200 lb. shuttle at each end of the cycle. And, positive cushioning of shuttle travel prevents damage to the transfer mechanism . . . protects valuable dies.

Valvair's deceleration manifold assembly uses only three SPEED KING valves; two to control cylinder movement, and one as a directional valve to select free or restricted exhaust for cushioning. Just two limit switches are needed to control cushioning action — a quick adjustment of exhaust restriction precisely regulates cushioning rate. Simplicity of design, plus SPEED KING multi-million cycle dependability, assures peak production rates, with minimum in-service downtime.

If control of fast-moving reciprocating mechanisms is a problem in your plant, ask your nearby Valvair representative for his recommendations. He's only a telephone call away.

For more information, write for Bulletin G-3A. Address Dept. TE-559, Valvair Corporation, Akron 11, Ohio.

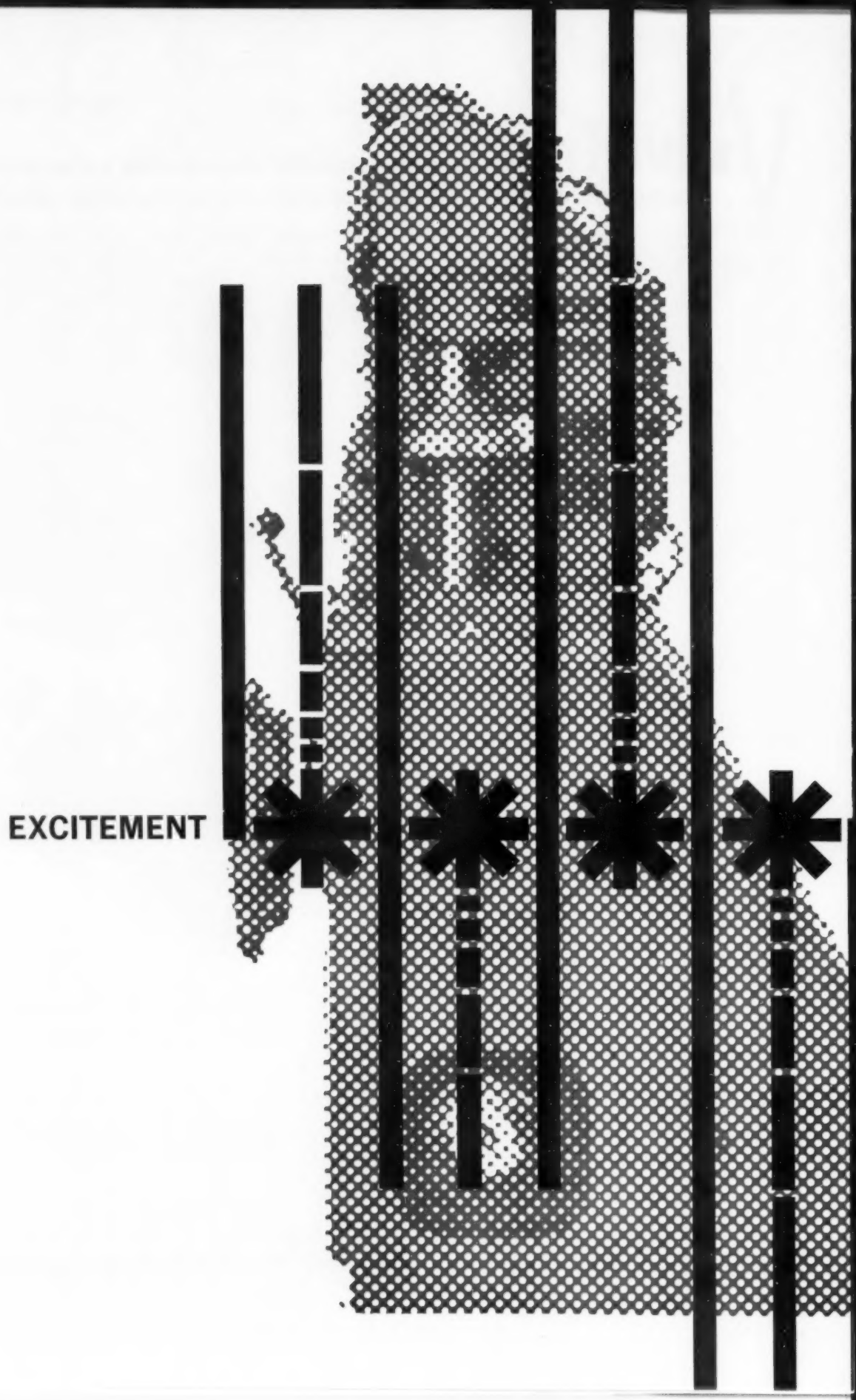
Representatives in principal cities

Valvair AKRON 11, OHIO

DIVISION OF INTERNATIONAL HARVESTER EXPORT CO. (INT.)

Other INDUSTRIAL DIVISIONS of IBEC: The Sinclair-Collins Valve Co. The Bellows Co., Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio.

8018

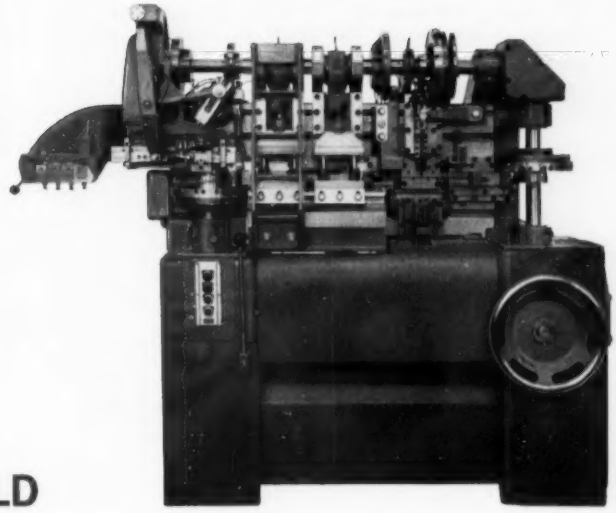

EXCITEMENT

Once in a blue moon, a really exciting new production machine is developed . . . and this is it!

It's the Torrington **Verti-Slide** which promises a genuine revolution in the production of just about everything in strip forming that is now being produced by progressively tooled presses.

Single-handed, the Torrington **Verti-Slide** has already demonstrated its ability to replace as many as six presses in high speed precision production of complex parts.

Cooler heads than ours are telling **us** that it's the most exciting new development in its field in half a century.



IN THE PRODUCTION WORLD

Write or call today for complete data—or a Torrington sales engineer.

THE TORRINGTON MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT · VAN NUYS, CALIFORNIA · OAKVILLE, ONTARIO

WALLACE BENDS

give tubing, pipe, structural shapes and solids the contour you need for the use intended. That is why production men have been bringing bending problems to Wallace since 1896. It is the time-proved way to bend a production curve upward and a cost curve down.

WALLACE BENDERS

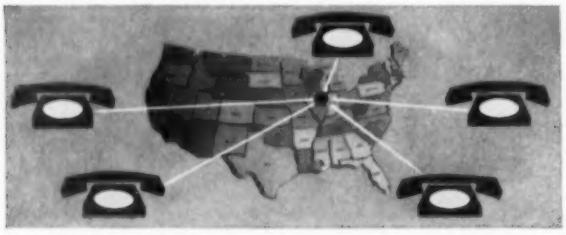
serve outstanding metal fabricators the world over, many of them exclusively. The complete Wallace line includes ram benders, rotary and roll benders, automatic and manually operated, in the widest range available. For the job you do, Wallace builds exactly the bender you need.

FROM YOUR DESK OR SHOP, ANYWHERE

CALL WALLACE COLLECT

BUckingham 1-7000, Chicago

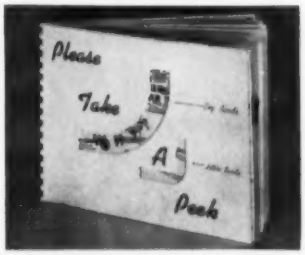
Ask for Bob Baxter. It's the quick, direct way to expert help on a bending problem. No charge to you. Wallace pays. Call Bob Baxter now.



SEE BENDING AS OTHERS DO IT

Pictures of actual bending operations abound in the Wallace "Take A Peek" Book. It's free. Get your copy.

Phone or Write
Bob Baxter



WALLACE SUPPLIES MFG. CO.
1304 W. Wolfram Street • Chicago 13, Illinois

USE READER SERVICE CARD; INDICATE A-5-192-1

FREE NEW-16 PAGE CATALOG
WRITE FOR YOUR COPY TODAY

JIG AND FIXTURE COMPONENTS

- LATCH BOLTS
- CAST IRON HAND KNOBS
- ALUMINUM HAND KNOBS
- QUARTER TURN SCREWS
- SHOULDER SCREWS
- JIG FEET (3 TYPES)
- SPHERICAL WASHERS
- FIXTURE KEYS
- KNURLED HEAD SCREWS
- TOGGLE SHOE CLAMPS & V-PADS

HOLD DOWN AND CLAMPING TOOLS

- T-NUT & STUD SETS
- STEP BLOCK & CLAMP SETS
- FLANGED NUTS
- CUT THREAD STUDS
- TEE NUTS
- COUPLING NUTS
- ADJUSTABLE STEP BLOCKS
- STRAP CLAMPS (PLAIN & STEP TYPE)

CATALOG INCLUDES TRACING TEMPLATES

Northwestern NORTH WESTERN
122 HOLLIER AVE., DAYTON 3, OHIO

USE READER SERVICE CARD; INDICATE A-5-192-2

Drive SET-UP COSTS Down!

Making set-ups for tapping and reaming can be done with Ziegler Tool Holders at a lower labor cost than with ordinary tool holders for the simple reason that it takes less time with a Ziegler.

Just align the work to within 1/32" of accuracy on the radius (1/16" on the diameter) and the job is done—because the Ziegler Holder automatically compensates for the inaccuracy.

If you have never used a Ziegler, a big surprise awaits you the first time you give it a trial.

Types to fit any machine used for drilling or tapping

PROMPT DELIVERY

W. M. ZIEGLER TOOL CO.
roller drive floating tool-holders
13566 Auburn • Detroit 23, Michigan

USE READER SERVICE CARD; INDICATE A-5-192-3

BATH Tap'n Gage TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 5

Subject: Tap and Screw Thread Nomenclature:

ALLOWANCE: The minimum clearance or maximum interference which is intended between mating parts.

ANGLE OF THREAD: The angle included between the flanks of a thread measured in an axial plane.

BACK TAPER: A slight taper on threaded portion of the tap making the pitch diameter near the shank smaller than that at the chamfer.

BASIC: The theoretical or nominal standard size from which all variations are made.

CHAMFER: The tapered and relieved cutting teeth at the front end of the threaded section. Common types of chamfer are taper, plug and bottoming.

CREST: The top surface joining the two sides or flanks of a thread.

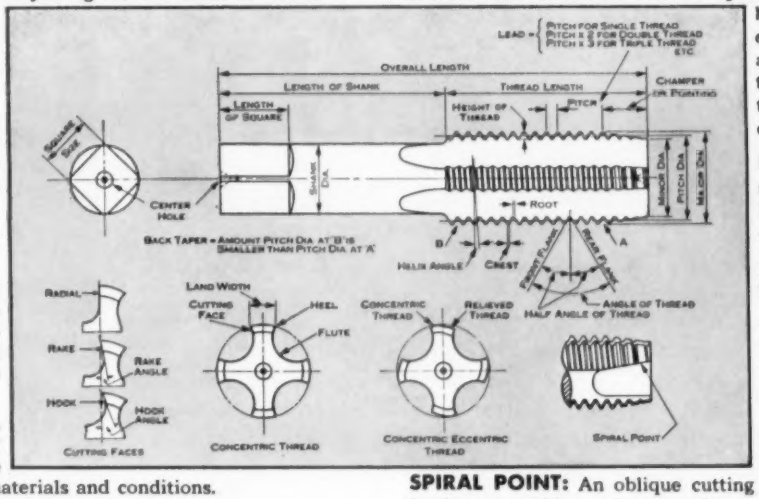
CUTTING FACE: The leading side of the land.

FLUTE: The longitudinal channels formed on a tap to create cutting edges on the thread profile.

HEEL: The following side of the land.

HEIGHT OF THREAD: In profile, distance between crest and bottom section of thread measured normal to the axis.

HOOK FACE: A concave cutting face of the land. This may be varied for different materials and conditions.



INTERRUPTED THREAD: Alternate teeth are removed in the thread helix on a tap having an odd number of flutes.

LAND: One of the threaded sections between the flutes of a tap.

LEAD OF THREAD: The distance a screw thread advances axially in one turn.

MAJOR DIAMETER: The largest diameter of the screw or nut on a straight screw thread.

MINOR DIAMETER: The smallest diameter of the screw or nut on a straight screw thread.

NECK: The reduced diameter, on some taps, between the threaded portion and the shank.

PITCH: The distance from a point on one thread to a corresponding point on the next thread, measured parallel to the axis.

PITCH DIAMETER: On a straight screw thread, the diameter of an imaginary cylinder where the width of the thread and the width of the space between threads is equal.

POINT DIAMETER: The diameter at the leading end of the chamfered portion.

RADIAL: The straight face of a land, the plane of which passes through the axis of the tap.

RAKE: The angle of the cutting face of the land in relation to an axial plane intersecting the cutting face at the major diameter.

RELIEF: The condition created by removing metal from behind the cutting edge to produce clearance and reduce friction. Usually applied to larger taps where drag is a problem.

ROOT: The bottom surface joining the flanks of two adjacent threads.

SIDE OR FLANK OF THREAD: The surface of the thread which connects the crest with the root.

SHANK: The portion of the tap by which it is held and driven.

SPIRAL POINT: An oblique cutting edge ground into the lands to provide a shear cutting action on the first few threads.

SQUARE: The squared end of the tap shank.

THREAD: The helical formed tooth of the tap which produces the thread in a tapped hole.

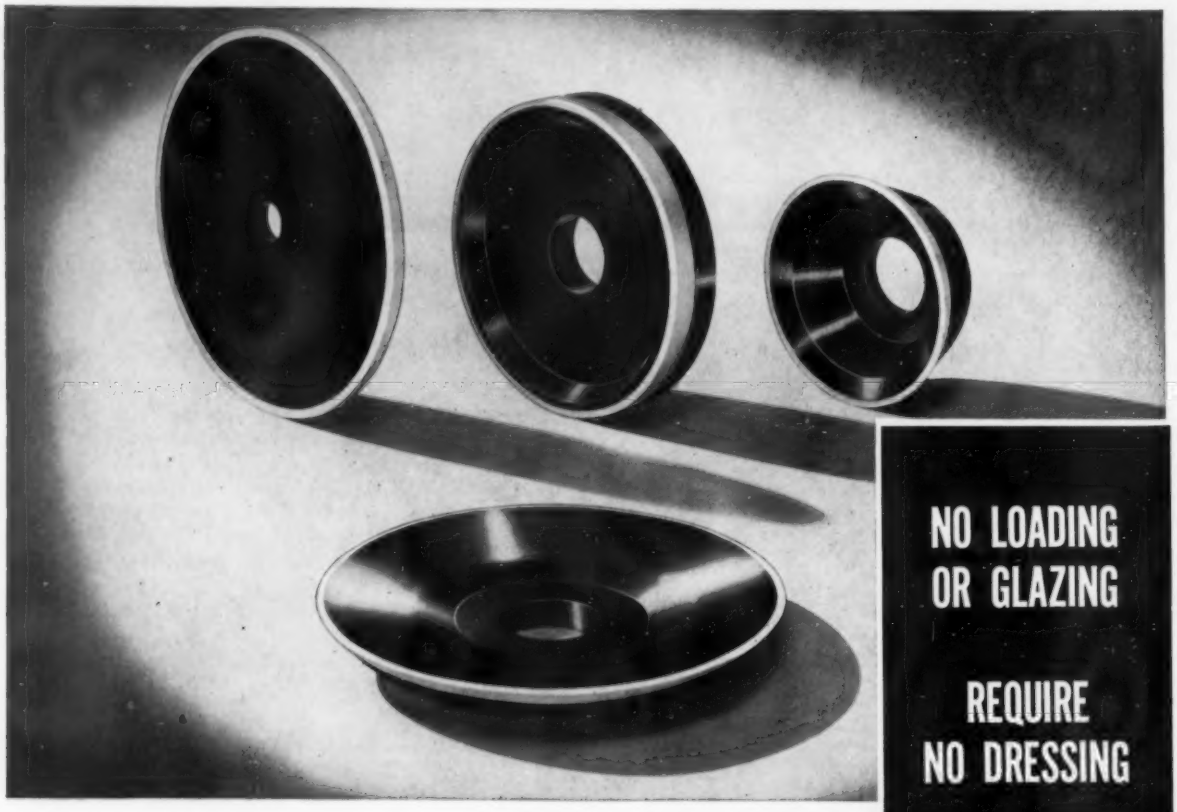
THREAD LEAD ANGLE: The angle made by the helix of the thread at the pitch diameter, with a plane perpendicular to the axis.

THREADS PER INCH: The number of threads in one inch of length.

THREAD: SINGLE: A thread in which lead is equal to pitch. DOUBLE: A thread in which lead is equal to twice the pitch. TRIPLE: A thread in which lead is equal to triple the pitch.

• Cylindrical and Thread Gages • Ground Thread Taps • Internal Micrometers John BATH & Co., Inc.

28 Mann Street, Worcester, Mass.



NO LOADING OR GLAZING

REQUIRE NO DRESSING

BONDED FOR SPECIFIC GRINDING REQUIREMENTS

NATURAL OR MAN-MADE DIAMONDS

MANHATTAN DIAMOND WHEELS

CUT FASTER, COOLER . . . LONGER

Every Manhattan Diamond Wheel is specially *bonded* to assure precision grinding at top speed without loading or glazing. Resinoid bonded for tungsten carbide grinding, they cut cool and free with lightest pressure . . . eliminate danger or damage to heat-sensitive carbide. Special metal bonds give you the finish you want for glass, quartz and ceramics. They require no dressing — for either wet or dry grinding.

Manhattan Diamond Wheels give you faster, cooler cutting action *plus* higher wheel efficiency and longer life on the toughest jobs. Specify from Manhattan's wide variety of surface-contact shapes . . . in the diamond concentration and grit size best suited for your surface, cylindrical, or internal grinding operations. You get "More Use per Dollar" with Manhattan Diamond Wheels.

RM 947

GRINDING WHEEL INSTITUTE MEMBER

WRITE TO DIAMOND WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

• GREATER IN PERFORMANCE

• LOWER IN COST

THE NEW *Parker Majestic*

No. 2 UNIVERSAL GRINDER

For many years, Parker-Majestic has manufactured machine tools that have given precision performance at lower costs. This important factor will again be found in the new Universal Grinder which brings to industry a much wider range of grinding operations.

FEATURES:

1 Electromagnetic reversing transmission

2 Dial type speed selector for wide range of table traverse and work head rotational speeds.

3 100% universal. Capable of generating angles, both OD and ID.

PARKER - MAJESTIC PM PRECISION MACHINES

PARKER MAJESTIC, INC. DETROIT 7, MICHIGAN

PORTA-CHECK®
A transistorized portable comparator for fast accurate measurement in both "tenths" and "thousandths" scales.

MODEL AG AIR GAUGE
For checking diameters, dimensions, roundness, etc.

200 SERIES MICROMETER DIAL INDICATOR
One of four sizes. Made to AGD specifications.

NO. 2 DIAL COMPARATOR
For desk, bench or at-the-machine inspection of small parts.

AMES

Masters of Measurement...

For more than half a century, Ames measuring instruments have been regarded as the finest made. Today the constantly growing line of Ames indicators, gauges, micrometers and comparators includes such amazingly accurate instruments as the new Ames "PORTA-CHECK", an electronic comparator which gives accurate readings *in millionths of an inch*; and the new Model AG air gauge—also accurate to millionths of an inch. Wherever precision is *really* important . . . you'll find Ames "masters of measurement" on the job.

Representatives in Principal Cities

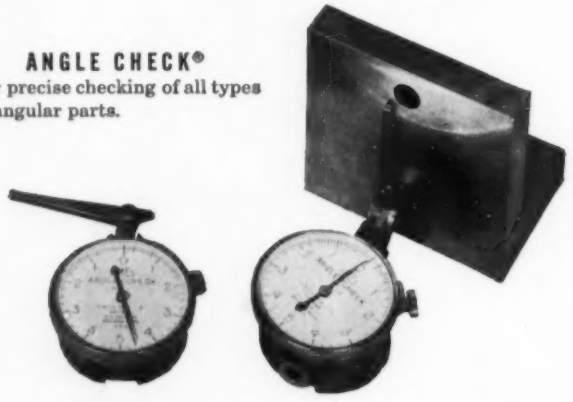
B.C. AMES CO.

30 Ames Street, Waltham 54, Mass.

Canadian Office — B. C. Ames Co., 45 Oriole Parkway, Toronto

MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAUGES

ANGLE CHECK®
For precise checking of all types of angular parts.



HERE IS *QUALITY* AT A SENSIBLE PRICE

the *NEW* CLEARING-HARRISON

11" MODEL JUST $1,950*

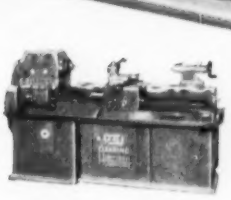
*Base Price F. O. B. Chicago.
†Los Angeles and New York

Not only does the Clearing-Harrison look like a lathe that should cost 50% more than its list price, it performs that way. And it will continue to perform year after year as only a fine machine tool built to uncompromisingly high standards of precision can.

It has taper roller bearings in the spindle, hardened and ground ways, precision hobbed, heat treated nickel chrome gears. A removable section in the bed provides a gap giving a maximum swing of 18¼" on this 11" lathe. These and other fine features are found only in the Clearing-Harrison—sold and backed by Clearing division of U.S. Industries, Inc.

Delivery is immediate on this and on 13" and 16" lathes, too. Find out more about these and the many other benefits you get on the Clearing-Harrison. Write Clearing for details.

Clearing, division of U. S. Industries, Inc., also manufactures the Clearing-Axelson line of engine lathes, power presses of all types, dies and special tooling, and special equipment for the aircraft and missiles industry.



● 13" Swing $2,950

● 16" Swing $4,450

Also available with factory-built copying attachments.

Coast to Coast Service Facilities

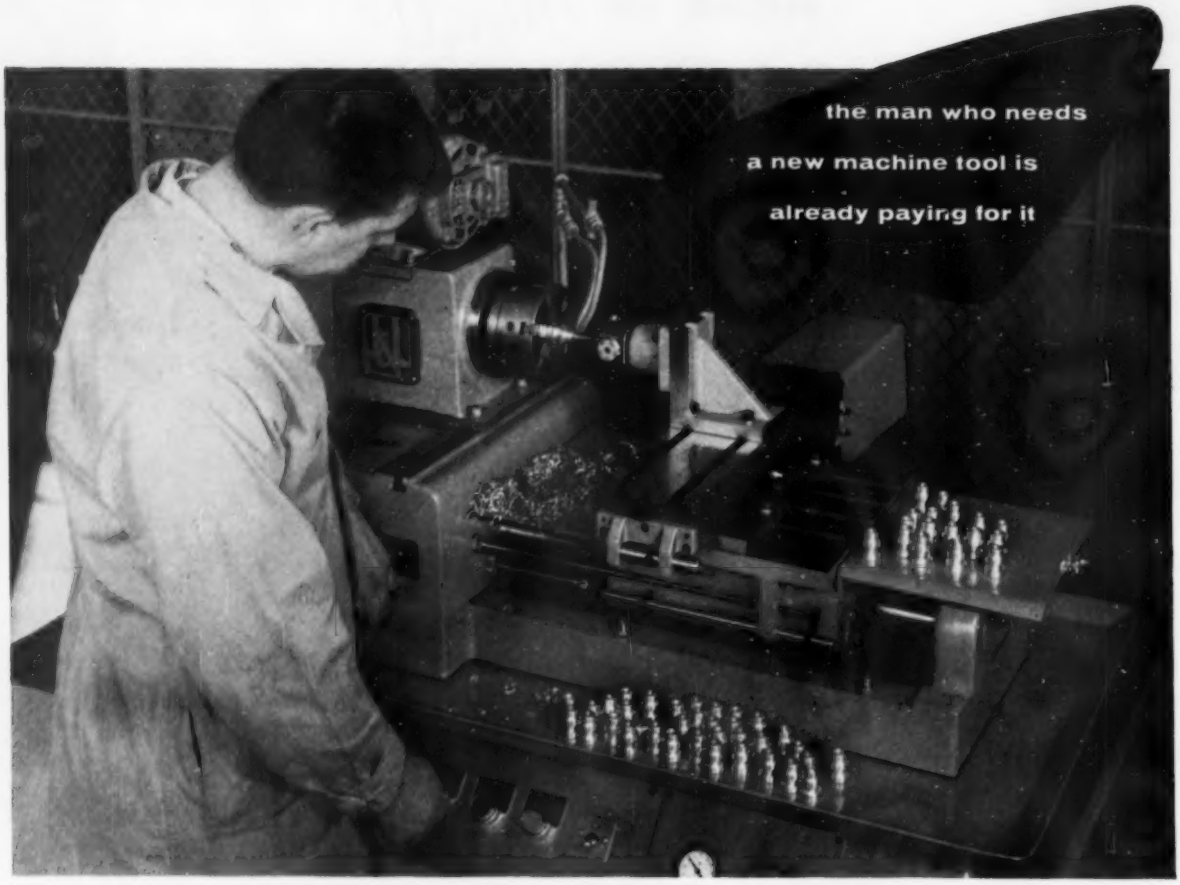
Clearing's nationwide facilities assure you of prompt service always. Replacement parts and accessories are stocked at Clearing and are available through all three plants, at all service centers and through all Clearing dealers.

USI Clearing

DIVISION OF U. S. INDUSTRIES, INC.

6499 W. 65th Street • Chicago 38, Illinois

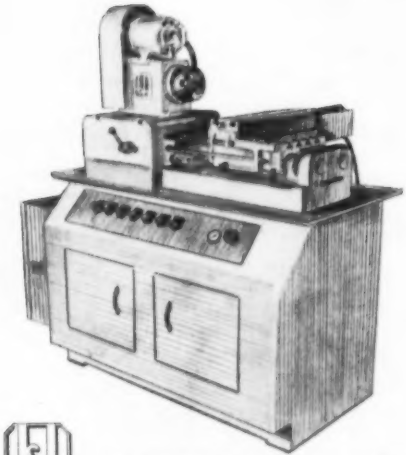
Plants in: Chicago, Ill. • Hamilton, Ohio • Los Angeles, Calif.



"Stingiest" Machine ever made

The J & L Precision Boring Machine is a mechanical tightwad: "Savings" for the owner are written all over it.

To begin with, its purchase price is far less than you would guess. Then, after it is set up, you find that just about anyone can handle its push button operation. Its simple design doesn't require expensive maintenance either.



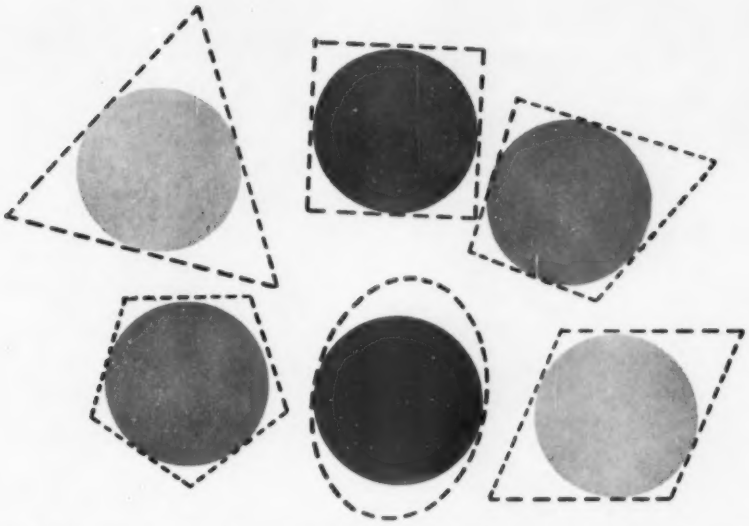
This machine's "tightness" extends even to the spindle. It's not only extremely accurate, but also allows adaptation of various types of tooling. It has a threaded nose that will accept all standard air, or manually operated chucks and an inside taper to accommodate 5C collets.

Think that's economical? Well this penny pincher will turn, face and bore at high production rates, yet, because tooling combinations can be shifted quickly, it takes care of the short runs too.

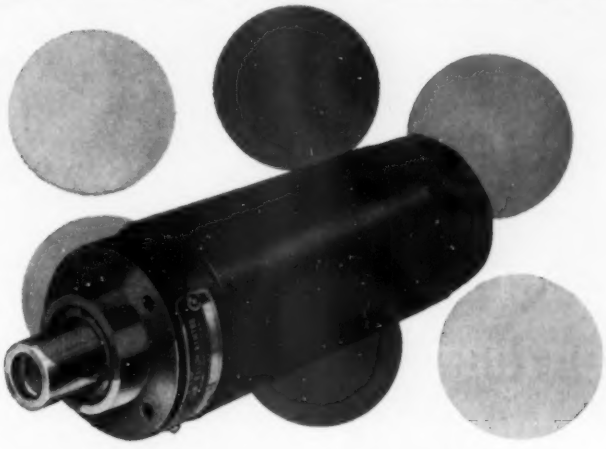
One other thing about the J & L Precision Boring Machine . . . it has a tendency to push its owners into a higher income bracket. If this prospect leaves you undaunted, write for further information.

JONES & LAMSON Machine Company • Dept. 710, 518 Clinton St., Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



Air 150 psi
Hydraulic up to 1500 psi
Meet JIC Standards
Series 101A



O-M Cylinders Fit Where Others Won't

THESE original space-saving O-M cylinders do more than fit into unusually close quarters too small to accommodate tie-rod cylinders of the same size bore. They save weight, improve appearance and assure smooth, dependable performance within a wide range of operating pressures. In addition, they are readily modified to serve in special applications, requiring semi-standard cylinders. And, the O-M Internal Locking Key, that makes it possible to orient the ports to any position, simplifies disassembly, inspection and service, eliminating alignment problems upon assembly. Completely interchangeable mounts and parts.

Available in 1½" to 8" bores with standard or heavy-duty piston rods.

Mail coupon today for 28-page Bulletin 101A replete with engineering drawings of cylinders, mounts, mounting brackets, capacity chart, and other performance data.

ORTMAN-MILLER MACHINE CO.
13 143rd Street Hammond, Indiana

■ Have representative call
■ Send Bulletin 101A

NAME_____ POSITION_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

BULLARD

"H.B.M., Model 75 is better than any other machine we've ever seen."

This statement by Mr. John Gruber, Plant Foreman of George Hantscho and Company, Inc., Mount Vernon, New York, manufacturers of printing equipment, sums up their experience since installing the Bullard 4" H.B.M., Model 75, in June 1957.

He further states "our presses and paperfolding machines are made to order and each job varies from the one before it. Because of this, we can't use assembly line or mass production techniques."

"The only mass production we have is the machining of holes in cast iron, up to as many as 105 in a side frame. Since we've been using our Bullard H.B.M., Model 75, with BULLARD AUTOMATIC POSITIONING we have not spoiled a single piece due to the malfunctioning of the machine."

Do you know the full story on the Bullard H.B.M., Model 75? If not, it will pay you to call your nearest Bullard Sales Engineer — he'll be glad to give you all the details or write

THE BULLARD COMPANY BRIDGEPORT 9, CONN

FOR THREADED INSERT DRIVING and Stud Setting and Pulling

Automatic Self-Opening Stud Driver — 100 Series Featuring Collapsible Type Trip Gage!

Automatic take-up for wear on jaws. Affords accurate maintenance of projection heights. Inexpensive method of clutch renewal gives double wear at half the cost.

"Extracto" Stud Remover for Aircraft Engines

Small tool nose diameter for use in close quarters. Permits re-use of studs by gripping thread on nut end of stud—will not mar threads. Made in standard sizes for #10 to ⅝" studs.

"Bull Dog" Stud Driver Designed for Use With Impact Wrenches

Built for rugged use on heavy engines. Equipped with Titan Design, Loose Pressure Plunger. Definitely stands up under vibration encountered when using an impact wrench for motive power.

Titan "Roll Grip" Combination Stud Driver and Puller

Incorporates roll action to grip as little as ½ in. of unthreaded body of stud. Made in standard sizes from 3/16 to 3 in. inclusive.

TITAN TOOLS — World's Largest Producers Of Stud Drivers And Pullers

TITAN TOOL CO.

44 MAIN ST., FAIRVIEW (ERIE COUNTY), PA.

USE READER SERVICE CARD; INDICATE A-5-201-1

TRACINGS PRINTS • SHEET MATERIAL

• SOLD DIRECT ONLY Write to Dept. TE
P.O.B. St. Clair Shores, Mich. • PRescott 3-2515

ROLL & FILE SYSTEMS, INC. P. O. BOX 3863 B DETROIT 5, MICH

MULTIROLL FILES

MODEL	49 Tube 1¼" I.D.	25 Tube 2¼" I.D.	Depth
	49AB	25AB	11¼"
	49CD	25CD	22¼"
	4930	2530	30½"
	4936	2536	36½"
	4942	2542	42¼"
	$7.50	$7.00	
	$9.50	$9.00	
	$12.80	$11.80	
	$13.80	$12.80	
	$14.80	$13.80	

USE READER SERVICE CARD, INDICATE A-5-201-2

TRIED • PROVEN • GUARANTEED MICRO MINIATURE END MILLS

3 Flute 2 Flute Single End
Ball End Flat End Double End
4 Flute ⅛" Shank 3/16" Shank

Stub Length—1/32" Increments from 1/32" to 3/16"

Now 1/64" Increment Sizes in 2 Flute Single End type

When you think of small END MILLS —think of MICRO MINIATURES

DISTRIBUTORS *in principal cities*

Write for Catalog

WOODSON TOOL CO.

4811 LENNOX BLVD. INGLEWOOD, CALIF.

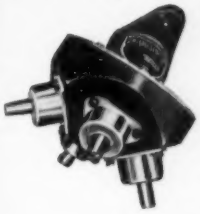
USE READER SERVICE CARD; INDICATE A-5-201-3

THE TOOL ENGINEER *has inserted another page in the 1959 calendar . . .*

Yes, this year there will be 13 issues of your official Society publication, THE TOOL ENGINEER. Starting with the SUPPLIERS DIRECTORY ISSUE, which comes out on June 15th, you will be receiving thirteen issues annually. Yearly revision of the Suppliers Directory will assure the readers and users of this unique publication a reliable guide to the local sources of hundreds of products which they use, maintain, specify and purchase. The Directory is tailored specifically to the needs of tool engineers—something which is available from nowhere else but . . .

THE TOOL ENGINEER

STREAMLINE YOUR DRILL PRESS OPERATIONS WITH . . .



quadrill

(4 POSITION TURRET HEAD)

DRILL, REAM, COUNTERSINK, COUNTERBORE on the same drill press! No need to set up for each operation. A simple rotation of this turret head brings any of 4 drills or cutting tools into position. Speeds production—cuts cost!

NOW!

quindrill

(5 POSITION TURRET HEAD)

All the easy-operation features of the Quadrill . . . plus an *extra* spindle!

FOR FAST, ACCURATE TAPPING— USE THE **quadtapper**

Fits any spindle on the Quadrill and Quindrill only.

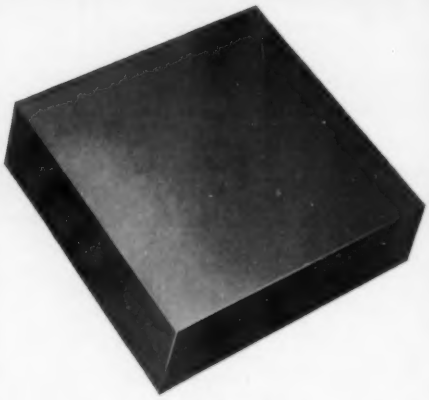
CHICAGO QUADRILL Company
1852 BUSSE HIGHWAY • DESPLAINES, ILL.

WRITE TODAY FOR COMPLETE INFORMATION

USE READER SERVICE CARD; INDICATE A-5-201-4

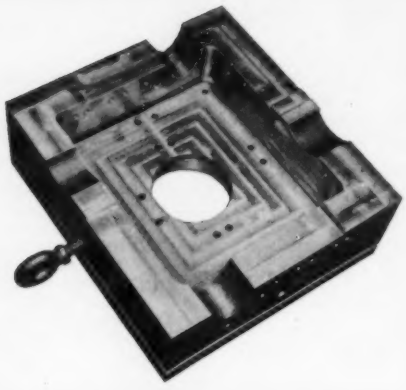
WHY BUY METAL YOU DON'T USE?

Switch to Allegheny Ludlum Cast-to-Shape Tools



FORGING

1250 lb. block, with 150 hours of machine time costing $1000, is necessary to fabricate die retainer.



CAST-TO-SHAPE

Cast-to-shape die retainer to hold automobile horn die weighs only 650 lbs., a $250 savings.

$1250 saved by changing to Cast-to-Shape tool steel

Paying for metal that ends up chips on the floor is a costly proposition these cost-conscious days. Here are two good reasons why you should switch your tool-making to Allegheny Ludlum cast-to-shape tools.

CAST-TO-SHAPE MEANS YOU BUY FEWER POUNDS OF METAL.

For example the manufacturer of automobile horns above saved 600 pounds of expensive alloy steel by specifying a cast-to-shape die retainer instead of fabricating it from a forged block. Result? A savings of $250, including the slight pattern cost.

CAST-TO-SHAPE MEANS LESS FINISH MACHINING.

To machine a retainer from the block above would have taken 150 hours of machine time at a cost of more than $1000. The Cast-to-Shape retainer is within ¼ to ⅛ inch of *finished* size, requiring only a *slight* roughing and finishing operation.

Allegheny Ludlum, a tool steel producer who makes cast-to-shape tools, casts them with the same precise quality control for which their tool steels is known. A full line of cast-to-shape tool steel grades is available. You'll find ones with high resistance to abrasion, compressive strengths of approximately 400,000 psi, easy machinability, hardening with almost no distortion, toughness, high red hardness, and the capacity to take a high polish.

Find out now how you can cut costs on your complex tools. Write for FC-4, a 28-page technical discussion of A-L's Forging and Casting Division with applications, pattern information, design tips, analyses, and heat treating instructions. Or call your nearest A-L tool steel warehouse or distributor.

ALLEGHENY LUDLUM STEEL CORPORATION, OLIVER BUILDING, PITTSBURGH 22, PENNA.
Write to Dept. TE-17

WSW 7575

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country . . . Check the yellow pages

EVERY GRADE OF TOOL STEEL . . . EVERY HELP IN USING IT

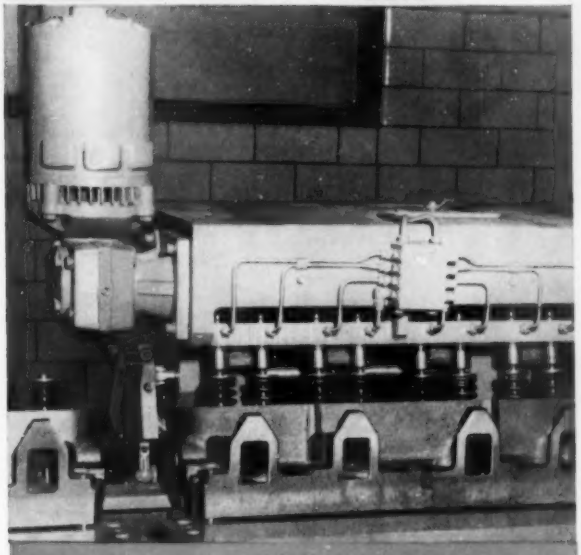
Where continuous automatic operations demand

double insurance against downtime

the leading choice is standardized

BOSTON Gear® SPEED REDUCERS

NO DOWNTIME for motor repairs. The standard end-mounted motor on BOSTON Gear RATIOMOTORS is easily detached by removing the bolts holding the motor to the gear unit flange. A spare motor can be attached, and operations resumed in a few minutes. Gear unit remains undisturbed, preserving alignment.



BOSTON Gear Vertical Right Angle RATIOMOTOR drives the valve "popping" (final test) unit in a giant 29-station transfer machine for continuous automatic assembly of cylinder heads.

BOSTON Gear Horizontal Right Angle RATIOMOTORS drive magnetic belts which convey parts from lower storage bins to vibratory hoppers at start of 13-station, automatic assembly of roller skate wheels.

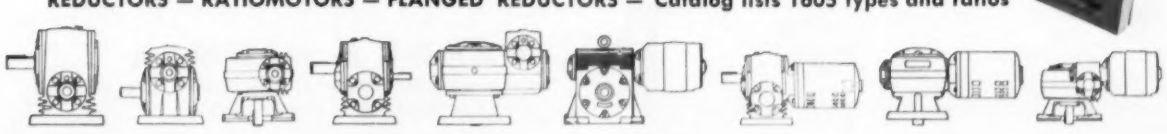
BOSTON Gear RATIOMOTORS are the leading choice for all types of installations where downtime would be disastrous to production schedules. One reason is BOSTON Gear quality standards, which assure highest efficiency and extra service life of the gear unit. Another is BOSTON Gear design leadership like the detachable motor which permits continued operation with a spare, avoids downtime. Design around BOSTON Gear RATIOMOTORS for this *double* insurance against downtime. All types and ratios are *standardized stock* models, quickly available anywhere from over 100 BOSTON Gear Distributors. Boston Gear Works, 83 Hayward Street, Quincy 71, Massachusetts.

Advt. copyright by Boston Gear Works

From Stock!
AT YOUR NEARBY BOSTON Gear DISTRIBUTOR

— STANDARDIZATION PAYS —

REDUCTORS — RATIOMOTORS — FLANGED REDUCTORS — Catalog lists 1605 types and ratios



Handy & Harman EASY-FLO 35 So Effective Yale & Towne Redesigns 39 Parts for Silver Brazing

See This Being Made at the Design Show

...BRAZED Fork Lift Clutch Cage jolt and accident proof

Clutch cage for Yale & Towne's Industrial Trucks; fabricated by John V. Potero Company, Inc., Philadelphia.

One of the problems in operating a fast-moving, stop, go and back-up fork lift truck is accidental overtravel of gear-shifting from forward to reverse and vice versa. The result, of course, is a useless unit.

This simple clutch cage makes it impossible to jam a fork lift's gear box with resulting time lost for repair. The operator can't make a mistake.

The frame and shaft, of separate pieces, are made of mild steel. The shift lever lock, in the center of the shaft, is made of hardened steel. It is positioned by two tubular sleeves of mild steel. The entire assembly is hand torch-brazed with EASY-FLO 35 and HANDY FLUX with no loss of hardness.

Welding was considered but rejected because of the necessary follow-up of "spatter" cleaning. With simple silver brazing, flux removal is the only finishing operation required. This, plus the fact that silver brazing is much *easier* (your operator need not be a practiced "torchbearer"), has prompted Yale & Towne to redesign thirty-nine of their parts and components so that they can be brazed.

Come see this part being brazed at the Design Engineering Show in Philadelphia, May 25 through 28; at Handy & Harman's Booth 115. Any questions you may have between now and then about silver alloy brazing and the benefits it imparts to thousands of components, parts and assemblies, may be addressed to Handy & Harman, 82 Fulton Street, New York City 38.

FOR A GOOD START: BULLETIN 20.
This informative booklet gives a good picture of silver brazing and its benefits... includes details on alloys, heating methods, joint design and production techniques. Write for your copy.

Your NO. 1 Source of Supply and Authority on Brazing Alloys

HANDY & HARMAN
General Offices: 82 Fulton St., New York 38, N.Y.
DISTRIBUTORS IN PRINCIPAL CITIES

OFFICES AND PLANTS
ATLANTA, GA.
BRIDGEPORT, CONN.
PROVIDENCE, R. I.
CHICAGO, ILL.
CLEVELAND, OHIO
DETROIT, MICH.
LOS ANGELES, CALIF.
OAKLAND, CALIF.
TORONTO, CANADA
MONTREAL, CANADA

ANOTHER MEMBER-SERVICE BY ASTE

THE TOOL ENGINEER Suppliers Directory Issue— a thirteenth issue of THE TOOL ENGINEER

WITH THE PRODUCT INFORMATION SERVICE YOU ASKED FOR!

EVERYTHING YOU NEED— IN ONE CONVENIENT SOURCE

Locate the product—*fast*
Products Section contains 1,000 classified product headings, plus 15,000 manufacturers' listings.

Locate the supplier—*fast*
Manufacturers Section lists 2,500 manufacturers, with home office addresses and 45,000 coded sales office listings.

Locate the closest source—*fast*
Sales Office Section contains addresses and phone numbers of more than 18,000 manufacturers' agents, distributors and sales offices, arranged by state and city.

The 13th issue of THE TOOL ENGINEER is reader-engineered to give you the local source for over 1,000 metalworking products.

The information contained in the Directory Issue was supplied by over 2,500 manufacturers and is authoritative and up-to-date. It will be the first Directory Issue of its kind—tailored for quick use. It is organized alphabetically, cross-referenced and indexed to insure constant and easy use.

The manufacturers' sales and service outlets in your area will be at your finger-tips to give you immediate assistance to your everyday tool engineering problems.

In addition to this time-saving information, you will find helpful engineering articles prepared by the editors of THE TOOL ENGINEER.

THE TOOL ENGINEER Suppliers Directory Issue is the thirteenth issue of THE TOOL ENGINEER and will be included as a regular issue in the basic subscription price to ASTE members and non-members.

ASTE

THE TOOL ENGINEER Suppliers Directory Issue

Publication Date: June 15, 1959

THE AMERICAN SOCIETY OF TOOL ENGINEERS

New 40-TON DOUBLE CRANK O.B.I. ROUSSELLE

WITH NEW ELECTRICALLY CONTROLLED AIR CLUTCH

- "Plug-in" foot and hand controls.
- Single stroke, continuous and jog selector.
- Low air consumption.
- Large die area.
- Roller bearing flywheel.
- Bronze main and crank bearings.

No. 4B ROUSSELLE PRESS

CHOICE OF 30 SIZES AND TYPES IN 5 TO 40-TON PRESSES

SERVICE MACHINE CO.

Mfrs. of Rousselle Presses

2310 WEST 78th STREET • CHICAGO 20, ILLINOIS

ROUSSELLE PRESSES ARE SOLD EXCLUSIVELY THROUGH LEADING MACHINERY DEALERS

USE READER SERVICE CARD; INDICATE A-5-206-1

EACH Severance CARBIDE HAND FILE SAVES US $30.00 A WEEK!*
* on basis of actual reports
MANY SPECIAL APPLICATIONS IN USE
HARD ABRASIVE MATERIALS POSE NO PROBLEM
CAN BE RESHARPENED MANY TIMES
AN $8.00 RESHARPENING WILL OUTLAST APPROXIMATELY 150 ORDINARY STEEL HAND FILES
START SAVING YOUR DOLLARS QUICK!
We'll send you information and prices via RETURN MAIL!
Phone, wire or write us Now! ☆ PHONE SAGINAW 3-8421
Severance TOOL INDUSTRIES INC.
728 Iowa Avenue Saginaw, Michigan
MIDGET MILLS
REGRINDING
INSIDE DEBURRING CUTTERS
OUTSIDE DEBURRING CUTTERS
HAND DEBURRING CUTTERS
TUBE END DEBURRING CUTTERS
BALL BURR REAMERS

USE READER SERVICE CARD; INDICATE A-5-206-3

The new Grind-A-Matic is an air turbine grinding head which can be mounted either vertically or horizontally on almost any machine tool.

Its versatile application and high precision performance allow Grind-A-Matic to perform grinding operations normally done on an expensive jig grinder. Mounted the same as any standard tool, it becomes a close tolerance grinder for such work as internal grinding of tools, dies and fixtures.

Threadwell

GRIND-A-MATIC

provides jig grinder performance at drill press prices

- *Fine radial adjustment from "0" to .070" while the spindle is rotating.*
- *Uninterrupted precision grinding*
- *Coarse adjustment from "0" through 1¼"*
- *Spindle speeds from 50 to 75,000 RPM*
- *Standard range from ⅛" to 2½" holes*
- *Adapted to include holes up to 5½"*
- *Sealed air turbine and spindle bearings*

Threadwell THREADWELL TAP & DIE CO. Greenfield, Mass.

USE READER SERVICE CARD; INDICATE A-5-206-2

oil-resistant **CAN-PRO** *Way Guards*

✓ PROTECT MACHINES
✓ CUT DOWN TIME
✓ KEEP WAYS CLEAN

Sizes and types to meet every need

Oil-and-wear resistant coated fabric. Accordion type for vertical, horizontal or angular positions.

Write for prices today!

CAN-PRO Corporation 36 E. McWilliams St. Fond du Lac, Wisconsin

USE READER SERVICE CARD; INDICATE A-5-206-4

USE GATCO ROTARY BUSHINGS WITH Your Boring Bars FOR *ACCURACY* and *SAVE WEAR*

Eliminates expensive tool construction — Reduces tool wear — Prevents seizure and pilot breakage — Especially adapted where precision is required.

ORIGINATORS OF THE ROTARY BUSHING

GATCO ROTARY BUSHING CO.

ROTARY BUSHINGS

FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

42324 ANN ARBOR ROAD, PLYMOUTH, MICH. GLenview 3-2299

USE READER SERVICE CARD; INDICATE A-5-206-5

WHAT CAN THIS TAP MEAN TO YOU?

"The marking is conventional . . . with the exception of BAY STATE".

BAY STATE originally made this tough, short flute, spiral pointed, assembly type tap for rugged automotive assembly work. Its rigid construction provides the long tap life and high productivity needed for retapping under conditions of extreme and unavoidable misalignment. *BUT . . . it's resistance to breakage makes it particularly effective for tapping sheet metal and other thin sections.*

BAY STATE sales engineers . . . tapping specialists . . . can provide complete application engineering on any tapping problem. Prompt delivery is assured by full line inventories of distributors across the nation.

For detailed information on assembly type taps, see page 16 of Bay State Catalog 56.

BAY STATE TAPS

Bay State Tap & Die Company • Mansfield, Massachusetts

On the nearby shelves of your Industrial Supply Distributor.

ASTE COLLECTED PAPERS, 1959

Mail Your Order Today

ASTE COLLECTED PAPERS, VOL. 59, BOOK I may be ordered now. This set embraces papers presented at the 27th Annual Convention of the American Society of Tool Engineers in Milwaukee, Wisconsin, April 18-22, 1959. The set includes all papers for which manuscripts were received in time for preprinting. A complete list of the individual papers presented is given below:

TITLE	Paper No.
The History of Metal Cutting.....Eli Whitney Memorial Lecture III	
Design Problems with Precision Elephant Type Machine Tools	187
Current Developments in Numerically Controlled Die Sinking Machines	188
Machine Selection and Application in a Large Industrial Plant	189
Tooling Experiments Using Statistics	190
Welding of Tool Steels	191
Simplified and More Accurate Model Reproduction with RTV Silicone Rubber	192
A New Approach to Machinability Determinations	193
Power Measurements in Milling	194
Zero Point One	195
When does an Engineer Become a Manager?	†
For Better Understanding—of Your Business by Your People	209
Designs for Successful Living	210
The Tool Engineer & The Tools of Yesterday	211
Developing Creativity in Engineering	212‡
Human Factors Responsibilities of Design Engineers	213‡
The Potential Machine Designer	214‡

(The following PLANNING FOR PROFIT SEMINAR papers which are included in Vol. 59, Book I are also available as a separate book @ $6.00*)

Introduction to—Planning for Profit	196
Control of Overhead Costs	197
Capital Costs and You	198
Control of Research and Development Costs	199
Key Factors in Material Cost Control	200
Cost Control in Quantity Production	201
Cost Control as Exercised by a Machine Tool Manufacturer	202
Control of Labor Costs	203
Cost Control Thru Design	204
The Industrial Engineer's Responsibility for Design Cost Control	205
Management Controls Costs	†
Recapitulation of—Planning for Profit	207

NOTE: Individual papers may also be ordered at $1.00* each by circling paper numbers desired above. MINIMUM ORDER $1.00.

Collected Papers, Department 6
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 38, Michigan

Please send postpaid the following as checked:

☐ COLLECTED PAPERS, VOL. 59, BOOK I.....$10.00*
(See above list for individual paper titles.)
☐ PLANNING FOR PROFIT SEMINAR PAPERS...$ 6.00*
☐ COLLECTED PAPERS, VOL. 58, BOOK II.....$10.00*
(These papers were presented at the September, 1958 Semiannual Convention in Los Angeles.

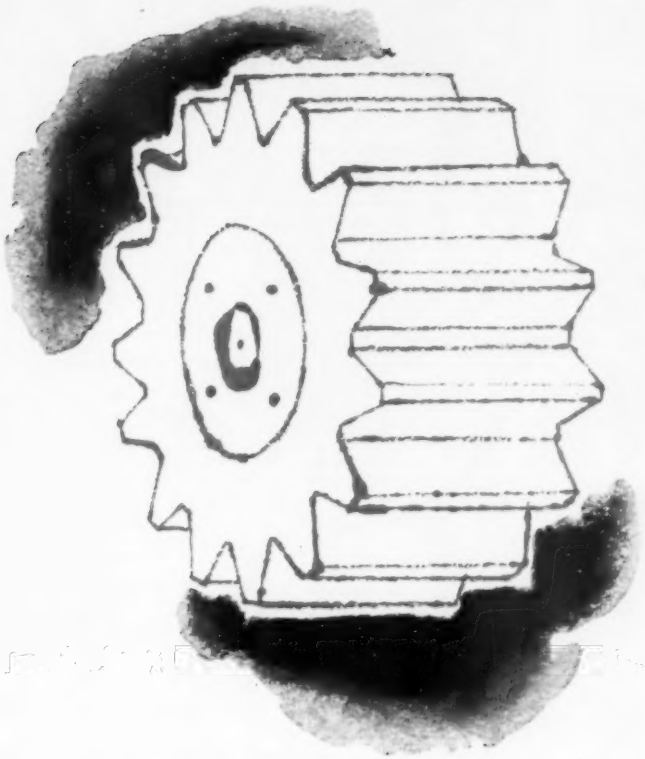
☐ TEN TECHNICAL PAPER COUPONS.....$ 3.00
(ASTE members *only* may purchase these coupons exchangeable for $5.00 worth of individual papers.)

†(Paper Not Available)
‡Previously Presented ASME Paper
* ASTE MEMBERS DEDUCT 50%

Name.....
(Please Print or Type)
Address.....
.....
City.....Zone.....State.....

MEMBER ☐ CHAPTER NO..... NONMEMBER ☐

FULL PAYMENT OR COMPANY PURCHASE ORDER MUST ACCOMPANY ALL ORDERS



Gears... Cutting Oils... and How to Save Money

The more gears your equipment can hob before tool change, the lower your cost of operation. Sinclair Ordnance Cutting Oils have earned the reputation for increasing tool life because of their high heat dissipation characteristic. Furthermore, a special E. P. agent assures the highest quality finish . . . more money saved through fewer rejects. Switch to Ordnance, now. Next time management asks how you've cut costs, tell them you've changed to Sinclair—and show them the results.

Call your Sinclair Representative for further information or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There is no obligation.

Sinclair
Ordnance Cutting Oils

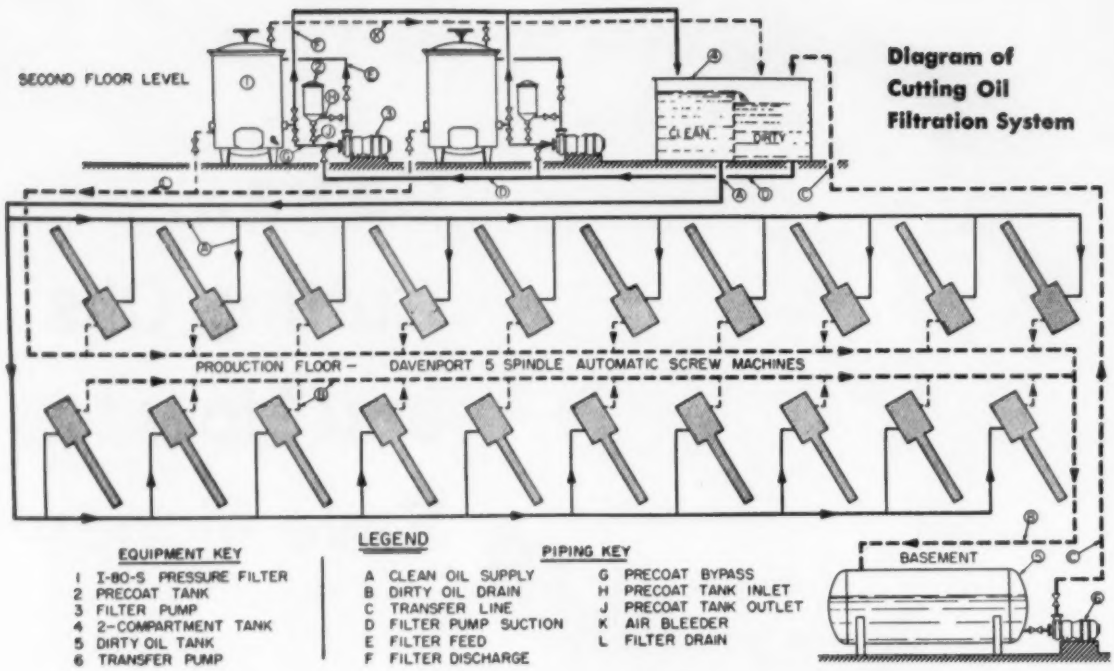


Diagram of Cutting Oil Filtration System

How Maximation Eliminates Hidden Machine Costs

. . . at the Teale Machine Company

By: H. L. Gaudriot, President
Teale Machine Co.

More than any other factor, high costs have been responsible for introducing a new efficiency concept in plants producing screw machine products. This reduction of operating expense with an increase in profits is termed MAXIMATION – getting maximum production from machine tools by eliminating hidden costs.

Responsibility Placed On Oil

At our plant in Rochester, N. Y., dirty cutting oil was preventing the plant's 24 Davenport 5 spindle automatic screw machines from functioning at their designed efficiency. Metal chips, solid abrasives, grit, dirt and fine particles in the oil stream were responsible for numerous extra costs. These included frequent down time for tool grinding and sump tank cleaning, shorter useful life of oil, poor product finish, many rejects and excessive maintenance. In addition, oil spillage created a waste and housekeeping problem. Handling of oil barrels was expensive, hazardous and untidy. To remedy the situation, the Teale Co. installed a complete Hoffman Central Pressure Filter System for reconditioning all cutting oil before it reached the automatic machines.

How Filters Operate

The central pressure filtration system includes 2 Hoffman Model I-80 S pressure filters with pre-coat tanks, chip wringers and motor driven pumps. Gravity flow through header pipes and lead-off lines delivers clean oil to each screw machine. As dirty oil enters the filter under pressure, it is filtered through a metal screen and thinly precoated with inexpensive filter-aid powder which is easily applied and easily removed. Valuable additives remain unchanged. After passing through the screen, the clean filtered oil flows down a center tube into the outlet manifold. From this point, the clear filtered oil is recirculated to the machines.

Benefits And Advantages

After one year of operation with the Hoffman system, maximation was achieved with these unprecedented production and operation savings:

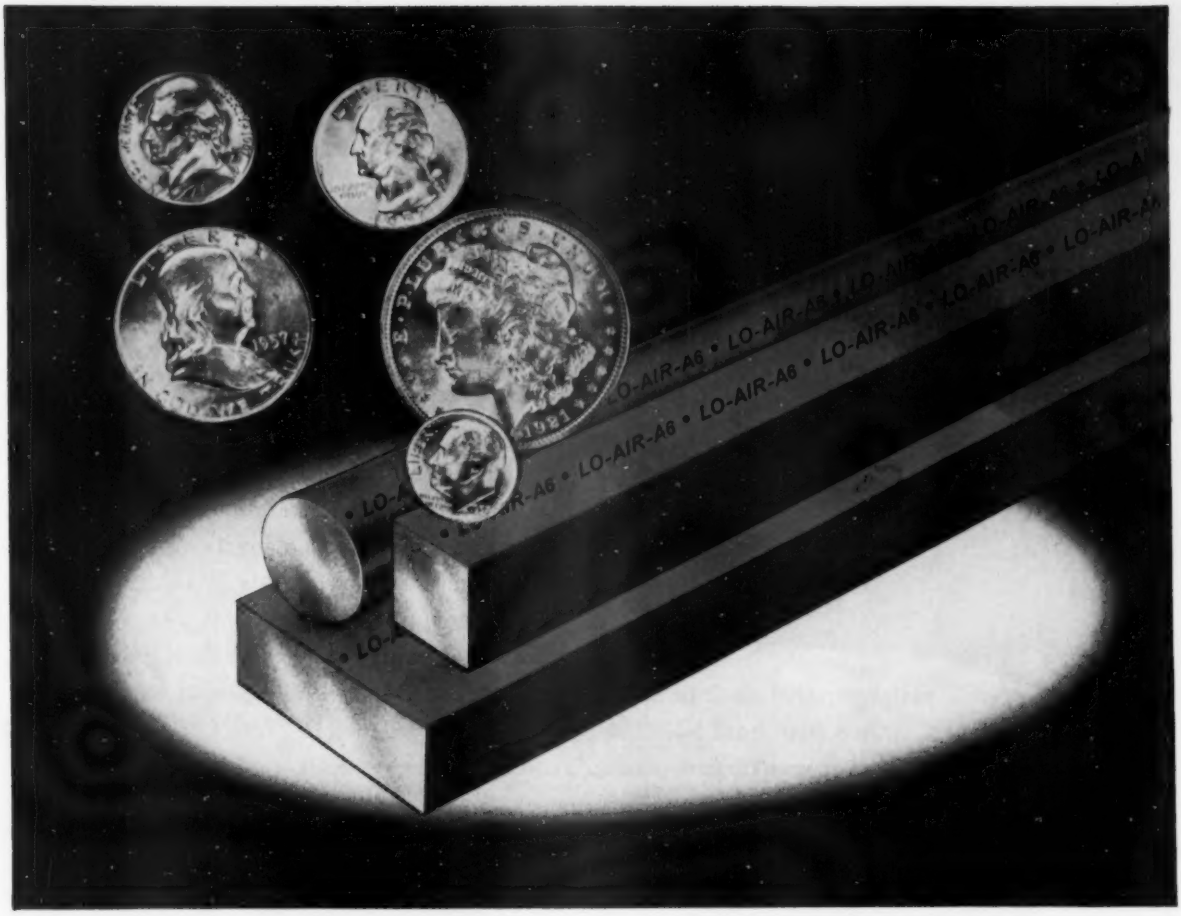
- Higher speeds, faster feeds, improved finishes, a better part at less cost.
- Fewer rejects – higher production rate.
- Longer tool life with clean oil free of chips and abrasive dirt particles.
- No loss of oil during chip removal.
- Greatly reduced down time. Cleaner floors. Oil waste reduced to a minimum.
- Maintenance of individual motor pumps completely eliminated.
- Actual records showed the yearly oil loss reduced to .1665 gallons per production hour or an approximate saving of 21.7%.

Maximation Pays For Itself

The Hoffman Central System has made it possible to effect actual economies which have enabled us to pay for the installation in a satisfactory period of time. Reduced maintenance, longer tool life, improved product finish and other benefits have saved us thousands of dollars in turning out a million parts a day. Filtration by Hoffman is the ideal way to maintain clean cutting oil.

Comparable maximation results have been obtained at the Utica Drop Forge Div. of the Kelsey-Hayes Co., the Air Reduction Co., Kearney & Trecker Corp., Taylor Instrument Co., etc. etc. To check on the applications of individual tool and complete central pressure filter systems for cutting oils, water base coolants, grinding oils, honing and lapping oils, petroleum solvents, industrial waters and other fluids in your plant, send for free Bulletin FB100 and case histories.

Write U. S. Hoffman Machinery Corp., Dept. T-1, Industrial Filtration Division, Thompson Road Plant #1, Syracuse, New York.



THERE'S A BONUS IN EVERY BAR

LO-AIR TOOL and DIE STEEL

Gives You 4-Way Savings on Every Job

There's 75 years experience in specialty steels behind LO-AIR, Universal-Cyclops low temperature, air hardening tool and die steel. LO-AIR is remarkably free from distortion in hardening, sets new standards for machinability.

Check these four ways that LO-AIR can save you money, help you make more profit.

1. Excellent machinability—far easier than other air hardening grades of tool steels. Easier than oil hardening tool steel.
2. Can be hardened in the low temperature furnace—no need to pay the high cost of high temperature hardening.
3. Less distortion during hardening, which reduces your finishing costs.
4. Maximum safety—possibility of cracking during hardening greatly reduced.

Write for brochure No. TS-101, or start your bonus savings now by ordering your requirements from your nearest Universal-Cyclops sales office or warehouse today! Complete stocks —rounds, flats, squares and billets—available for immediate delivery.

U. S. Pat. No. 2,355,224

UNIVERSAL CYCLOPS
STEEL CORPORATION
BRIDGEVILLE, PA.

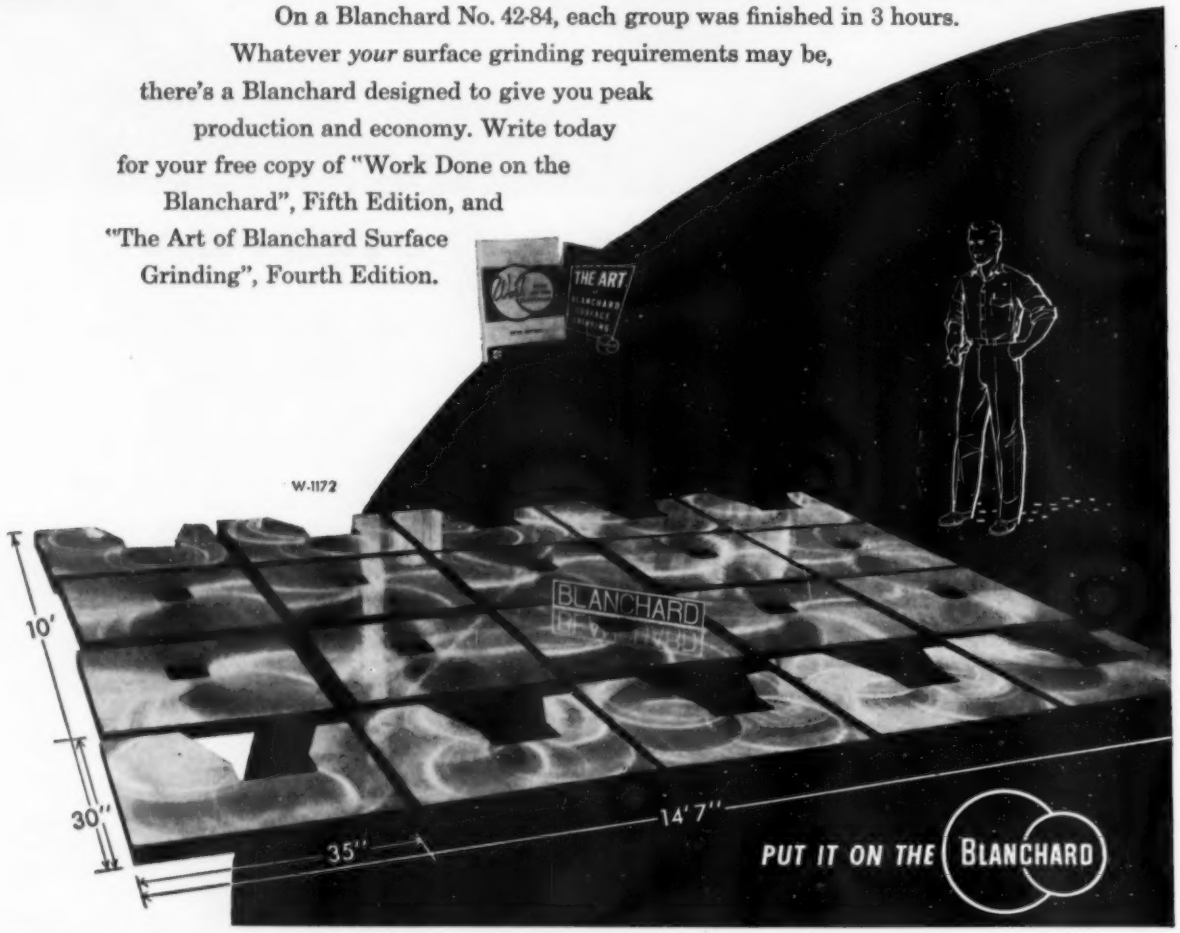
TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

Grinding Perfection is Assured When You "Put it on the Blanchard"

V-517

The production speed and precision of modern Blanchard Surface Grinders are illustrated by this interesting job, involving 20 plates measuring 30″ x 35″ x 3″. Ten of them had openings of 6½″ x 4″, the other ten had openings of 11″ x 20″. Each group of plates required stock removal of 5/32″ from two sides, with flatness of .003″. On a Blanchard No. 42-84, each group was finished in 3 hours.

Whatever *your* surface grinding requirements may be, there's a Blanchard designed to give you peak production and economy. Write today for your free copy of "Work Done on the Blanchard", Fifth Edition, and "The Art of Blanchard Surface Grinding", Fourth Edition.

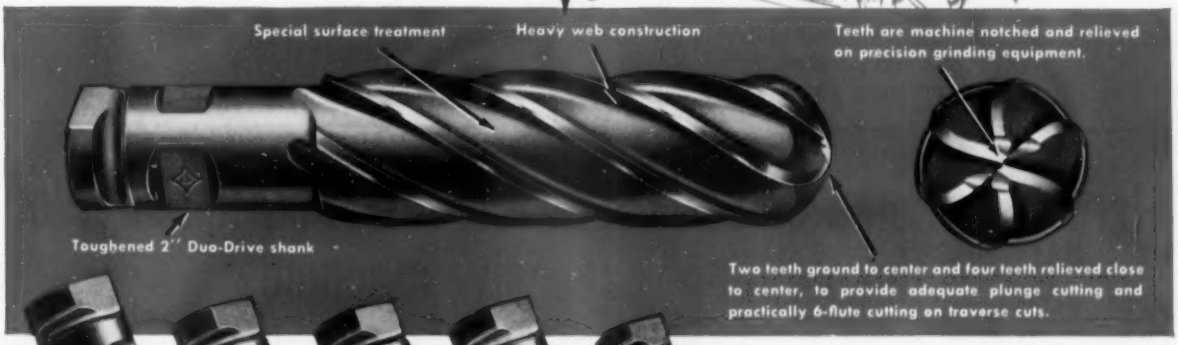


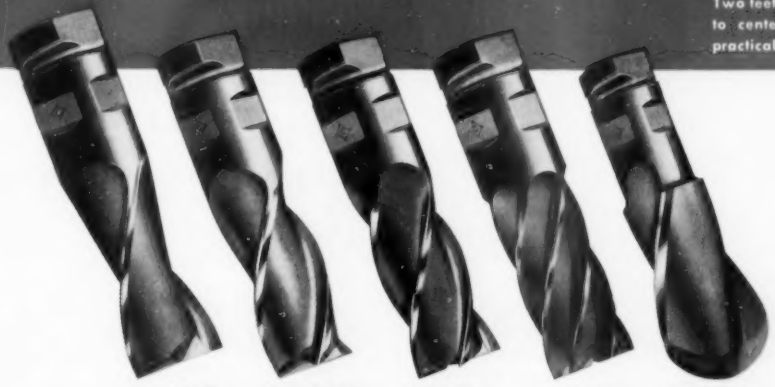
W-1172

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

NEW
CLEVELAND
6 FLUTE
HEAVY DUTY END MILLS

- For heavy duty applications which require larger radii in pocket bottoms and corners.
- Can be operated at higher feeds than 2-flute end mills, with less vibration and tooth impact.
- Will remove maximum amounts of metal with a minimum of cutting edge wear.
- Give superior performance in both plunge cutting and traverse cuts.


Special surface treatment
Heavy web construction
Teeth are machine notched and relieved on precision grinding equipment.
Toughened 2" Duo-Drive shank
Two teeth ground to center and four teeth relieved close to center, to provide adequate plunge cutting and practically 6-flute cutting on traverse cuts.



The complete line of

CLEVELAND
HEAVY DUTY
END MILLS
with DUO-DRIVE Shanks

For removing the maximum amount of metal at high feed rates, with minimum cutting edge wear.

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR
for CLEVELAND ◈ Quality Tools . . . *prompt delivery from stock*

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York • Atlanta • Cleveland • Detroit • Chicago • Dallas • Los Angeles • San Francisco

WHERE DO YOU LOOK FOR LOWER COSTS?

to longer life from a tool costing 4¢ an hour or to greater output from a machine that costs $8 an hour

THIS COMPARISON TELLS THE STORY
(This is only one of many examples . . . details of others on request)

	240 minute tool life setup TOOL COST: 4¢/hr.	25 minute tool life setup TOOL COST: 40¢/hr.
Machine cost per hour	$ 8.00	$ 8.00
Tool cost per hour	$ .04	$ .40
Cost per 8-hour shift	$64.32	$67.20
Pieces run per shift	51	181
COST PER PIECE	$ 1.26	$ .37

Here's how some shops have doubled...tripled...quadrupled the output of expensive machines

From many machine shops the story is the same—*they sacrificed low-cost carbide inserts through increased feeds and speeds . . . and achieved startling savings in total-cost-per-piece.* Production increases even greater than 100% have been recorded. The increased tool costs were insignificant by comparison.

Where machines have been operating at less than maximum efficiency, *unit cost can be reduced overnight* . . . merely by using modern cutting tools to get full potential machine output . . . instead of operating at fractional machine capacity to gain long tool life.

This idea has been PROVEN-IN-USE by many progressive plants. We will gladly send you records of such operations. These results can be duplicated in plants where machines and talented operators have been held back by old ideas about tooling and tooling costs. Ask your Kennametal Carbide Engineer how Kendex* (patented) tooling can help get more efficient output from *your* machines . . . or write KENNAMETAL INC., Latrobe, Pennsylvania, for additional information.

*Trademark

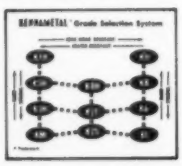
5791

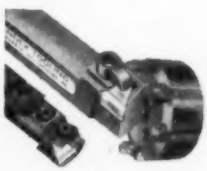
INDUSTRY AND
KENNAMETAL
. . . Partners in Progress

TO MULTIPLY YOUR MACHINE OUTPUT ...YOU NEED 3 THINGS:

The 'Three-Man Tooling Team' that utilizes the specialized knowledge of your Tool Engineer, your Machine Operator, and the Kennametal Carbide Engineer . . . *to get the right tooling on every job.*

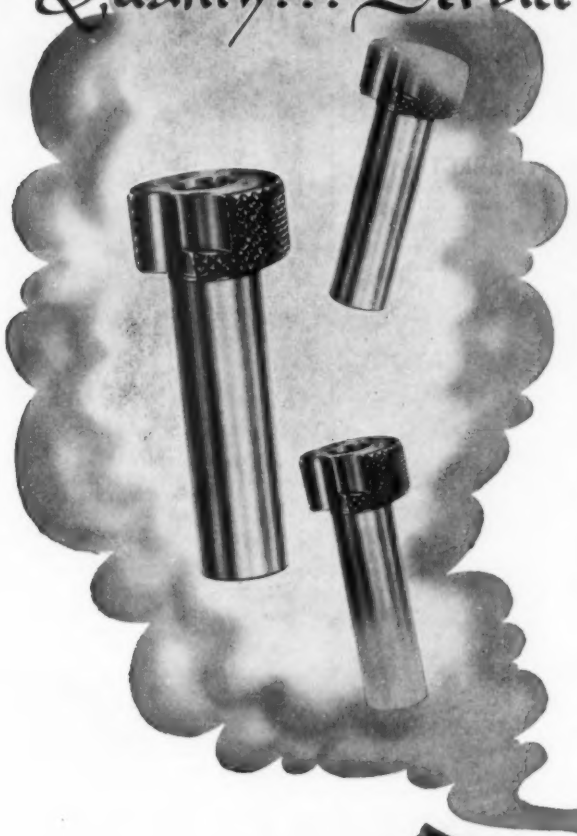
The Kennametal complete range of grades that provides the precise properties and uniformity that permits *accurate prediction of tool life.*





Kendex Instant insert change without need to reposition the tool. This is the key to this new practice . . . *frequent tool change without excessive down-time.*

Quality... Service... Dependability...



ACME
STANDARD AND A.S.A. BUSHINGS...

are designed and engineered for you, the ultimate user, with all the mystical qualities Aladdin found in his lamp.

A rub here, a polish there produces over 30,000 standard and A.S.A. drill jig bushings within tolerances of .0003 of an inch not to mention the genie-fast and dependable nation-wide distribution system which over 35 years of Acme service has built.

If you want the very best in quality, service, and dependability, *only* Acme can supply it.

For Acme Dowel Pin information or free pocket size selector, check coupon and mail today.

ACME
INDUSTRIAL COMPANY

ACME INDUSTRIAL COMPANY
214 N. Laflin St., Chicago 7, Illinois

- ☐ Send me your free Drill Jig Bushing selector.
- ☐ Send me information on your Drill Jig Bushing.
- ☐ Send me information on your Dowel Pins.

Name_____

Firm Name_____

Address_____

City_____ State_____

Hand Wheels
Carr Lane
...ARE BETTER
Wherever you need a handwheel - - - - order CARR-LANE "Tool Tested" HANDWHEELS. Scientifically designed for maximum Service, Balance and Feel. In Unfinished Cast Iron or Smooth Cast Aluminum with Revolving or Solid Handles
Use CARR-LANES other fine Jig and Fixture Components
Write for Catalog TO-DAY
Carr Lane
4200 Krause Court
St. Louis 19, Mo.

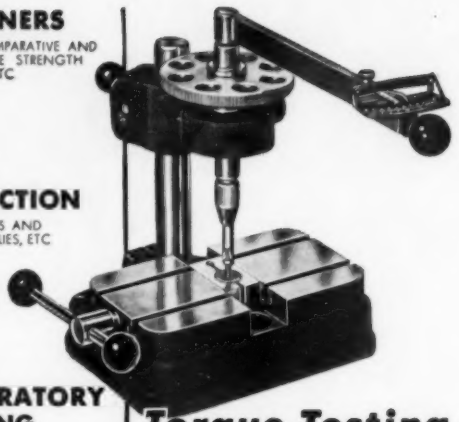
USE READER SERVICE CARD; INDICATE A-5-216-1

DESIGNERS
for COMPARATIVE AND ULTIMATE STRENGTH TESTS, ETC.

INSPECTION
of PARTS AND ASSEMBLIES, ETC.

LABORATORY TESTING
of SCREWS
SOCKETS
TAPS
LOCK NUTS
DRIVING BITS
HAIR SPRINGS, ETC.

PRODUCTION QUALITY CONTROL
for DELICATE OPERATIONS, ASSEMBLY OF FRAGILE MECHANISMS OR INSTRUMENTS; FOR FASTENERS IN PLASTICS AND LIGHT METALS.



Torque Testing FIXTURE

A universal fixture with 1000 uses. Holds driver in accurate alignment; in instrument bearings. Provides rapid engagement with test sample...torque is applied and measured with Sturtevant Torque Wrench.

Model TTF¼ *Capacity* **0-200 in. lbs.**
Model TTF½ *Capacity* **0-150 ft. lbs.**

Write for Bulletin TF

P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

USE READER SERVICE CARD; INDICATE A-5-216-3

NOW

On-the-Job Gaging with Accuracy to .00002"

Threadwell

DUAL RANGE S.I.
ELECTRONIC COMPARATOR

- Two ranges selected by a simple turn of the control knob
- Coarse range 200:1, fine range 2000:1
- Lifetime steel tipped gaging unit
- Perfect repetition not found in units costing much more
- No sensitivity to temperature change; allows use in any part of plant or shop
- Operating pressure of less than 3 ounces
- Work is slid under the gaging head tip
- Interchangeable tips for various applications
- Flexible zero adjustment on the most sensitive range. Gaging head can be set up in a simple split clamp without need for fine mechanical adjustment

See your Threadwell Distributor or write for free bulletin

Threadwell
THREADWELL TAP & DIE CO.
Greenfield, Mass.

USE READER SERVICE CARD; INDICATE A-5-216-2

ANOTHER SERVICE to ASTE Members

Everyone who subscribes to THE TOOL ENGINEER can look forward to receiving a very special bonus issue on June 15, 1959. The SUPPLIERS DIRECTORY ISSUE will present the industry's most complete and up-to-date guide to product information sources available anywhere. Whenever a tool engineer needs to know more about the specifications, prices, availability or functions of a given product, the SUPPLIERS DIRECTORY will guide him to the nearest *local* source of such information. As an issue of THE TOOL ENGINEER, the Directory will not be lacking in technical editorial content. Articles are planned to include such topics as Cost Estimating and Numerical Coding of engineering products. And, all of this will be provided at no additional cost.

KEARNEY & TRECKER *builds production*

MACHINE TOOLS FOR EVERY INDUSTRY

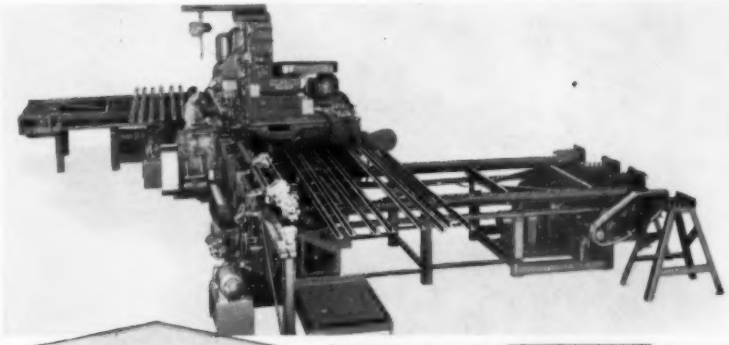
Since 1898 . . . Kearney & Trecker Customer Engineering Service — supported by an outstanding staff of engineers experienced in production milling machine design and application — combined with the finest and latest machine tools in an ultra modern plant is always ready to solve your production problems.

Oil Industry

automatic 4-spindle milling machine mills 4 rock bit cones *simultaneously*... in a trunnion-type fixture having 4 work-piece spindles. PRODUCTION — a constant flow of this expendable type tool to meet the steady demand.

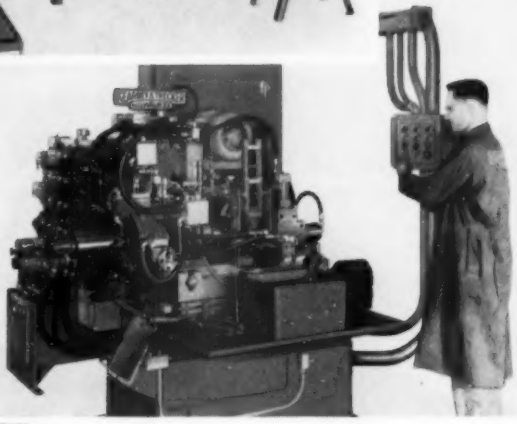
Automotive Industry

this 88 spindle, 3 vertical head machine performs drilling, chamfering, counterboring, trepanning, spot-facing, reaming and tapping operation on a differention case and cover. PRODUCTION — 67 cases, 67 covers per hour.



Elevator Industry

12 spindle automatic transfer machine mills mating tongue and groove on ends of elevator guide rail-drills mounting holes in rail flanges—for continuous rail mounting. PRODUCTION—28 completely machined rails per hour—180% increase over old method.



Tool Industry

Flutes and shank squares are milled on tap blanks by this automatic machine. Tap blanks are hopper loaded and automatically unloaded. RESULT—greatly increased hourly production.

KEARNEY & TRECKER MILWAUKEE ®

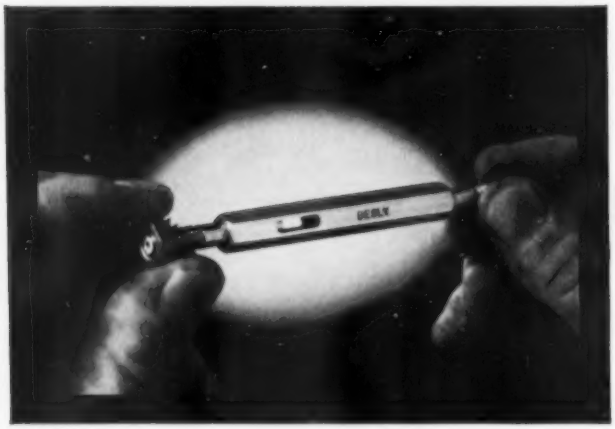
Write for bulletin SMD-57 on your company letterhead.

KEARNEY & TRECKER CORPORATION

Special Machinery Division

6772 W. National Avenue • Milwaukee 14, Wisconsin

New Besly CP-75 precision gages last 3-5 times longer



Now you can have Besly Precision Gages in *extra hard* chrome plate. Made to tolerances according to U. S. Bureau of Standards specifications, Besly CP-75 precision gages last from three to five times longer than ordinary steel gages. They give you more piece parts per gage, less downtime for gage inspections, lower gage inventory, and will not chip or peel. See your distributor, or *write us today for catalog giving complete information on our full line and prompt service.*

BESLY®

BESLY-WELLES CORPORATION
118 Dearborn Ave. South Beloit, Illinois

Grinders and Abrasives • Taps • X-Press Taps® • Drills • Reamers • End Mills • Tool Bits
Gages • Carbide Tipped Tools, Blanks, Lapped Toss-away Inserts and Holders

American Society of Tool Engineers

1960 TOOL SHOW

Detroit Artillery Armory

April 18-28, 1960

DETROIT, MICHIGAN

For information :

EXPOSITION COMMITTEE
American Society of Tool Engineers
10700 Puritan Ave., Detroit 38, Michigan

UNiversity 4-7300

Hex socket and Multiple-Spline socket

Bristol Dyna-Mites—miniature, No. 0, 1, 2 and 3, button-head and flat-head socket screws

Here's news for designers of precision equipment—electronic components—missile parts.

Precision Bristol button-head and flat-head socket screws are now available in smaller standard stock sizes than ever before—down to No. 0, in heat-treated alloy and stainless steel (other metals on special order).

Bristol is the first socket screw manufacturer to offer these tiny button-head and flat-head socket screws, aptly named "Dyna-Mites," as stock items—thanks to increasing demand from manufacturers of a wide variety of precision equipment. Larger sizes (to ¾" for flat-head and ⅝" for button-head) have been standard items with Bristol for many years.

The new button-head and flat-head screws will supplement Bristol's already extensive line of miniature socket cap and set screws in sizes down to No. 0, 1, 2, 3—long a Bristol specialty. They feature the same superior holding power under shock and vibration, can be wrenched up tighter and loosened, time after time, without damage to the socket. And they're made under the same rigid, exhaustive quality-control requirements.

Get complete data on these tiny Bristol Dyna-Mite button-head and flat-head socket screws from your authorized Bristol socket screw distributor, or write to the address below. A.9.4

Precision socket screw manufacturers since 1913
Bristol's Hex Socket Screws
Bristol's Multiple-Spline Socket Screws
*Made in sizes as small as No. 0 in Alloy Steel and Stainless Steel. Cap screws up to 1½" diam.
THE BRISTOL COMPANY
Socket Screw Division
Waterbury 20, Conn.

Come in and see us in Booth 1133 at the Design Engineering Show

USE READER SERVICE CARD; INDICATE A-5-220-1

they said it couldn't be done . . .
(But ASTE did it!)

RESEARCH REPORT 20

Even today there is a basic disagreement as to what happens when metal is cut. Results of step two of a mammoth research project undertaken two years ago by the ASTE Research Fund have been published as Research Report No. 20—AN EVALUATION OF THE PRESENT UNDERSTANDING OF METAL CUTTING. Authored by the Battelle Memorial Institute, the 275-page book—prepared by a battery of ten Battelle engineers and scientists—represents *the first attempt* to analyze, evaluate & distill more than 12,000 original writings—the metal cutting literature of the world! The final evaluation summarizes the current applications & theories used throughout industry. R.R. 20 is available from the ASTE Research Fund, SP-10, 10700 Puritan Avenue, Detroit 38, Michigan. ASTE MEMBER PRICE—$5.00 each; NON-MEMBERS—$7.50 ea.

AN EVALUATION OF THE PRESENT UNDERSTANDING OF METAL CUTTING

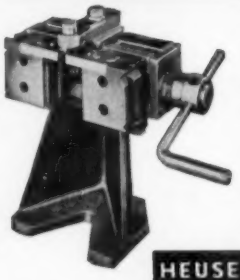
"Potential Savings to Industry Estimated in Billions"

MARVECO LIVE CENTERS
Guaranteed to outperform and outlast any other LIVE CENTER.
The WHOLE HEAD turns on Double Row Ball Bearings for Radial Load and Tapered Roller Bearings for Thrust Load.
MARVEL TOOL & MACHINE CO.
1086 North River Road • St. Clair, Michigan

USE READER SERVICE CARD; INDICATE A-5-220-2

SPEED UP DRILLING & TAPPING JOBS!

JOHN'S DRILL JIG



For cross or end drilling round, hexagon, or square stock or standard or odd-shaped rough castings from ⅛" to 8" O.D., the self-centering "John's Drill Jig"" will cut tooling and production costs to minimum for 10 to 100,000 pieces.

Standard removable slip fit bushings and holders available to drill center or mean off-center. The self-centering action will hold within .0015" or better regardless of jig wear or piece part O.D. variation. Jigs available in three sizes 6", 8", 14"; jaw openings 2", 3¼", 7½".

HEUSER MANUFACTURING CO.
1636 N. PAULINA ST., CHICAGO 22, ILL.

USE READER SERVICE CARD; INDICATE A-5-220-3

WHAT'S THE USE OF RUNNING WHEN YOU'RE HEADED THE WRONG WAY?

(With today's rising costs and highly competitive markets, there is no such thing as a "guaranteed annual profit." And the manufacturer who is not well informed on the latest developments in manufacturing cost control suffers a severe handicap.)

—All manufacturing companies share one common objective—making a profit. From the point of view of a tool engineer, profit is the difference between manufacturing cost and selling cost. There are only two ways to increase profits—the selling price can be raised—or costs can be reduced. Prices are largely controlled by the law of supply and demand, so management looks to the tool engineer for ways to increase profits—and tool engineers must know, in detail, what manufacturing costs are—and how to control them. Irrespective of the type of product, the basic considerations are essentially the same—THE PROFIT IS IN THE PLANNING!

—Tomorrow's production operation reflects today's planning. Is there any basic planning philosophy that can be generally applied? The answer surprised us . . . it may amaze you!

ANNOUNCEMENT

ASTE COLLECTED PAPERS, 1959 (Volume 59, Book 1) * ARE *NOW AVAILABLE* . . . to ASTE members at $5.00 each, and to non-members at $10.00 each.

This set embraces Papers presented at the 27th Annual Convention of the ASTE in Milwaukee, April, 1959. The Convention theme—"Planning for Profit"—seems particularly apt for Book 1 of the 1959 Collection. For here you will find *the most advanced and complete coverage available today*, on the factors that influence manufacturing costs—and the methods used in their control.

Graphically illustrated in a leatherette-bound volume, the twenty-six available Papers *include the ASTE "Planning for Profit" Seminar*—one of the Society's 1959 series of Creative Manufacturing Seminars designed to present the latest and best information on production methods currently available; three Papers by members of the *American Society of Mechanical Engineers* (presented in a joint ASTE-ASME session); the third annual Eli Whitney Memorial lecture on *"The History of Metal Cutting,"* and additional Papers relating to education, statistics, shop operations, machine tools and new tool engineering development.

ASTE COLLECTED PAPERS, 1959
VOLUME 59, BOOK 1

*A list of individual papers is available without charge.

FILL OUT AND MAIL TODAY

Please send "COLLECTED PAPERS, VOL. 59, BOOK 1" to the address below:

Payment enclosed in the amount of $_____ Orders shipped to Canada will enter the country duty and tax free. Remittance may be made in Canadian funds at the same prices. Shipments to other countries are subject to import regulations.

Name_____

Chapter (if member)_____

Business Title_____ Firm Name_____

Street Address (check: HOME ☐ BUSINESS ☐)_____

City_____ Zone____ State_____

Remittance payable to the Society must accompany order. Do not send currency. Mail this order coupon or a facsimile to: American Society of Tool Engineers, Dept. SP-9, 10700 Puritan Ave., Detroit 38, Mich.

IMPORTANT—In order to obtain the special, member price of $5.00, orders must be sent to the Society.

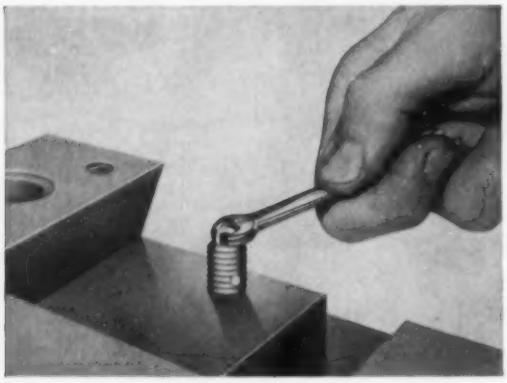
ASTE

AMERICAN SOCIETY OF TOOL ENGINEERS
10700 PURITAN AVE.
DETROIT 38, MICHIGAN

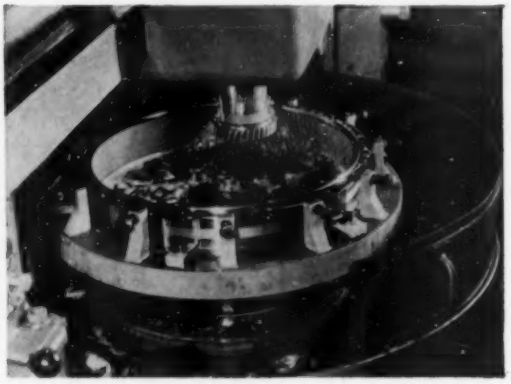
Practical Tooling Tips

No. 4 of a series

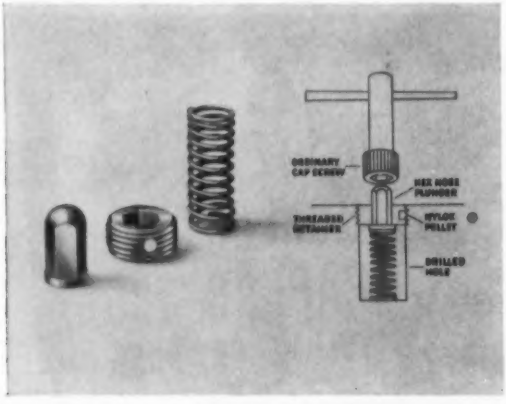
New uses are being found every day for Vlier Tooling Accessories. Perhaps the applications shown below will suggest ways you can profit by replacing costly, custom devices in jigs, dies and fixtures with precision, off-the-shelf Vlier products.



HEX NOSE SPEEDS INSTALLATION OF SPRING PLUNGERS—Vlier Hexnose Spring Plungers are easily installed with a simple end wrench. Eliminates hunting for special wrenches. Made to same exacting tolerances as Vlier Standard Spring Plungers. Available in many end pressures, diameters and lengths.



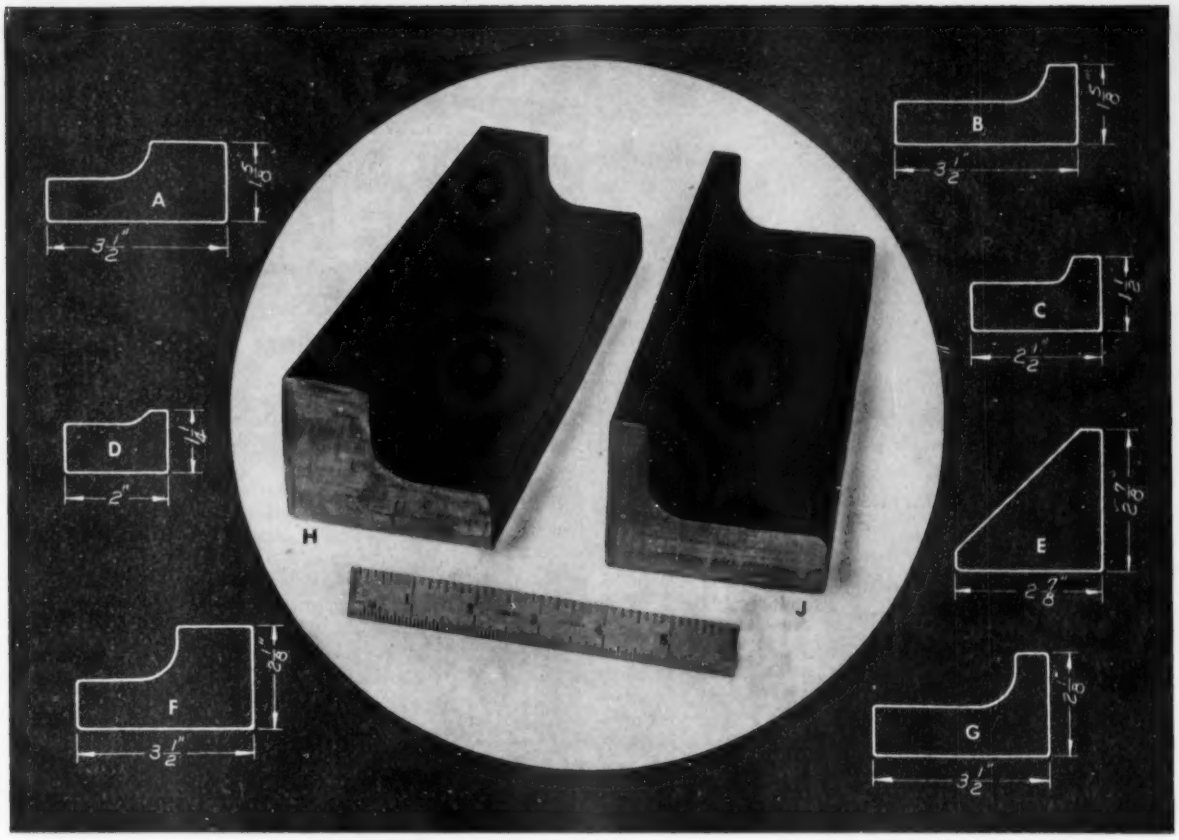
THIN-WALLED RING GEAR HELD SECURELY in fixture without distortion with 12 Vlier Torque Thumb Screws. Once pre-set end pressure is reached, knurled head spins freely, preventing overtightening. Checknut prevents backing off under vibration. Available in four types; various screw diameters and lengths.



NEW PLUNGER ASSEMBLY PREVENTS DAMAGE TO DIE STOPS—Plunger actuates automatic stop perfectly. Quickly installed, never needs adjustment. Hex nose mates with standard hex head bolts for easy insertion. Nylok® nylon pellet prevents threaded retainer from working loose. 6 sizes from ¼" to 1" diameter. Various end pressures.

FREE IDEA BOOKLET—Illustrations in this 16-page booklet show how others have profited from the use of Vlier Tooling Accessories. Shows both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

VLIER
Engineering Corporation
A subsidiary of Barry Controls, Inc.
8900 Santa Monica Blvd. • Los Angeles 46, California



UDDEHOLM Solid Tool Steel Shapes Help Build Better Dies

Building better dies is getting an important boost these days from the use of Uddeholm solid tool steel shapes. Die makers have found important advantages in the fact that these special shapes are *solid tool steel throughout*. As a result, any part of the shape can be used as a working surface. And their greater inherent strength eliminates any of the breathing action often occurring in composite sections. To get this strength you no longer have to machine a needed shape from a rectangular bar. Uddeholm can deliver it to you in a Swedish quality tool steel—saving both labor and machining time, and reducing scrap losses. Uddeholm special shapes are also large enough to be incorporated directly into the design of massive blanking and forming dies, or used for corner dies and power shear blades.

Shapes "H" and "J" above are 3½" wide by 2⅝" high. Both are stocked in water hardening (SAE 01) analysis, while shape "H" is also stocked in oil hardening (SAE W1) analysis. Supplied in 10 to 12 ft. random lengths, they provide great flexibility in making die sections to a wide variety of forms and lengths. Uddeholm's Swedish mills have rolls for all these shapes—and the production facilities to offer their usual prompt and efficient service.

Write For Tool Steel Stock List No. 13

UDDEHOLM COMPANY OF AMERICA, INC.

155 East 44th Street, New York 17, N. Y. • MUrray Hill 7-4575

UHB

TOOL AND DIE STEELS
COLD ROLLED SPRING STEELS

BRANCH OFFICES & WAREHOUSES: Long Island City, N.Y.: 22-14 37th Ave., MUrray Hill 7-4575 **Cleveland:** 4540 East 71 Street, Diamond 1-1110
Los Angeles: 5037 Telegraph Road, ANgelus 2-5121 **DISTRICT REPRESENTATIVES: Chicago:** Frank J. Mackin, Leroy E. Marshall, 55 East Washington, STate 2-1649
Detroit: Warren H. Nugent, 17304 Lahser Road, KEnwood 5-6340 **Philadelphia:** Frank T. Campagna, 1418 Walnut St., PEnnypacker 5-2114
Pittsburgh: Lohmeyer Steel Co., 345 Mount Lebanon Blvd., LOcust 3-0122
TOOL STEEL WAREHOUSE DISTRIBUTORS: Rockford, Ill.: Rockford Industrial Steel Service, 2229 Twenty-Third Ave. WOodland 3-5463

NOW HIGH PRECISION FOR EVERY SHOP AREA

with Cleveland's
TRANSISTORIZED INDICATOR
INDI-AC, Jr.
The INDI-AC, Jr. embodies most of the features of the standard INDI-AC electronic indicator

☆ **OPERATES ANYWHERE**
Portable — 4½ pounds — 6" x 7" x 3½"
AC and permanent, chargeable battery, operated
Unaffected by shop conditions

☆ **USE FOR ANY GAGING PURPOSE**
3 scales — thousandths — tenths — millionths
Zeros and readings coincide on all scales
Reversible action gage head. Light Tip Pressure.

☆ **NO MAINTENANCE PROBLEM**
Exclusive PROTECTOR TIP*
No battery replacement
Long life transistors
No mechanical parts to wear

other CLEVELAND PRECISION INSTRUMENTS

INDI-AC—Ultra-Precision Electronic Height Gage

MICRO-AC—Electronic Micro-Comparator

PAR-AC—Electronic Production Gage

INDI-RON—Ultra-Precision Roundness, Squareness and Concentricity Gage

ROUGHNESS METER—For surface finish measurement

AU-MAC—Automatic Machine Control and Positioning Systems

Ask for a demonstration and see why CLEVELAND Gages give you more.

*Patent Applied For.

Cleveland INSTRUMENT COMPANY
6220 East Schaaf Road • Cleveland 31, Ohio

USE READER SERVICE CARD; INDICATE A-5-224-1

JUST OUT!
NEW 1959 EDITION

free
84-PAGE CATALOG
One Complete Source of Detailed Specifications for Designers, Production Managers, Toolroom Foremen

Hundreds of NEW ITEMS

ALL NEW — Complete specifications and cost saving data on over 2000 "Standards", including world's largest line of work-holding equipment, chuck jaw blanks, handles, knobs, wheels, strap clamp assemblies, forged items, plus hundreds of other jig and fixture components. Detailed specifications, engineering drawings. The one complete source for data on all the "standards" for tool, die, jig, and fixture design and application.

Write for your FREE copy today.

JERGENS TOOL SPECIALTY CO.
Dept. TE-5 712 E. 163rd St., Cleveland 10, Ohio

USE READER SERVICE CARD; INDICATE A-5-224-2

GROTNES EXPANDERS

FROM THIS

Cylinder before expanding, 15" dia., 16" long. Mtl., mild steel, .050" thick. After expanding, dia. at flanges, 19", lgth., 12".

TO THIS

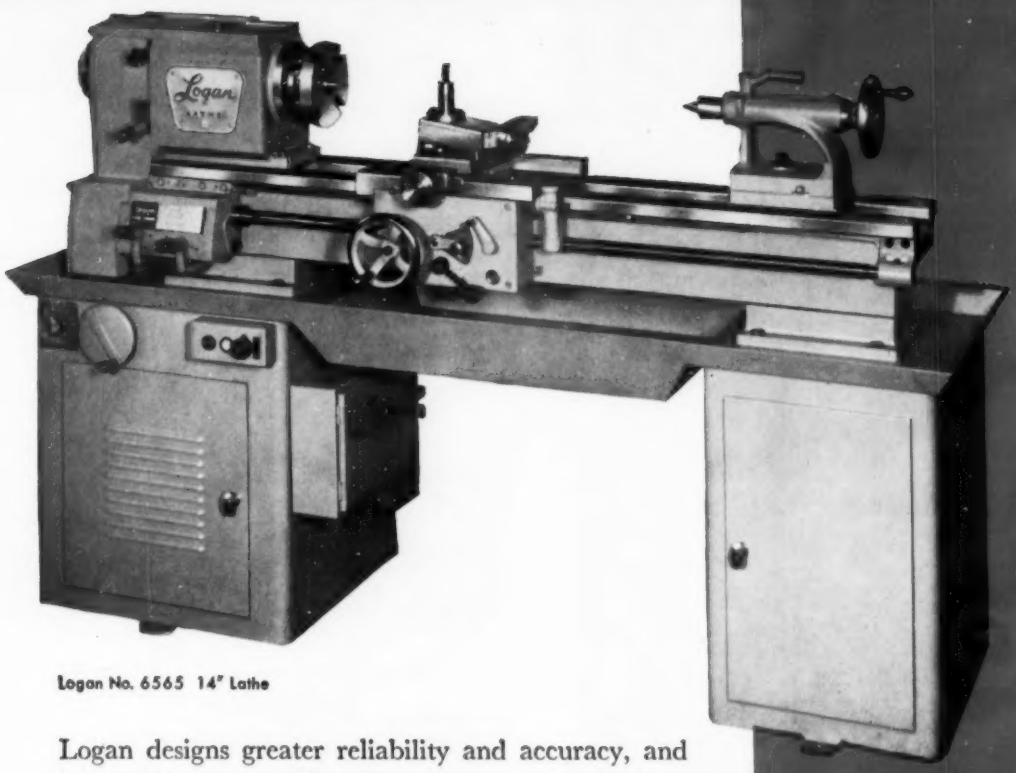
Grotnes Expanders, with low cost tooling, close tolerances, high production rates, cold form parts ranging from 4" to 100" in diameter, 1 inch to 15 feet in height. Write for details.

GROTNES
MACHINE WORKS
5454 N. WOLCOTT AVE.
CHICAGO 40, ILL.

USE READER SERVICE CARD; INDICATE A-5-224-3

its specifications add up
to high production capacity

Logan
14" Lathe



Logan No. 6565 14" Lathe

Logan designs greater reliability and accuracy, and longer life into its lathes by a generous combination of high-quality features. For instance—

- An oversize spindle with 1⅝" bore turns on four super-precision ball bearings with built-in preload
- A variable-speed drive lets you change speed while work is turning—without shifting belts
- A warp-free lathe bed with high, strong walls braced by oversize ribs to withstand heaviest stresses; two V-ways and two flat ways are flame-hardened and precision-ground.

There are many more reasons why this and other Logan Lathes have a greater capacity. The specifications tell the story. Write for literature and complete information.

- Spindle speeds to 2000 rpm.
- 1½" Levermatic collet chuck capacity
- 14⅝" swing over bed
- 9" swing over saddle cross slide
- 40" between centers

LOGAN ENGINEERING CO. Dept. U-559 4901 Lawrence Ave., Chicago 30, Ill.

Index of Advertisers

May 1959

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

*Exhibitor in 1958 ASTE Industrial Expositions

A

*Accurate Bushing Co. 121
*Ace Drill Corp. 143
Acme Industrial Co. 215
Airborne Accessories Corp. 116
*Airborne Instruments Laboratory 120
*Alina Corp. 130, 153
Allegheny Ludlum Steel Corp. 202
Allen Mfg. Co. 147
Alpha-Molykote Corp. 183
*American Brake Shoe Co.,
Denison Engineering Division 28
American Brass Co., The 16
*American Chain & Cable Co., Inc.,
Wilson Mechanical Instrument Division 160
*American Cystoscope Makers, Inc. 186
*American Drill Bushing Co. 8
*American Society of Tool Engineers 205, 208, 219, 221
American Tool Works Co., The 10
*Ames, B. C., Co. 196
*Anderson Oil & Chemical Co. 187
Armstrong-Blum Mfg. Co. 146
*Armstrong Bros. Tool Co. 131
*Austin Industrial Corp. 124

B

Baird Machine Co. 158
*Barber-Colman Co. 34-35
Bath & Co., John 193
*Bausch & Lomb Optical Co. 151
Bay State Tap & Die Co. 207
Bellows Co., The 30
Benerson Co. 161
*Besly-Welles Corp. 218
Bethlehem Steel Corp. 167
Bijur Lubricating Corp. 125
Blanchard Machine Co., The 212
Borg-Warner Corp.,
Rockford Clutch Division 132
Boston Gear Works 203
*Bristol Co., The 220
*Brown & Sharpe Mfg. Co. 26-27
*Brown & Sharpe Mfg. Co.,
Cutting Tools Division 150
*Buck Tool Co. 128
Bullard Co., The 200
Butterfield Division,
Union Twist Drill Co. 177

C

Can-Pro Corp. 206
Capewell Mfg. Co. 143
*Carr-Lane Mfg. Co. 216
*Cerro de Pasco Sales Corp. 182
Chicago-Latrobe 38
Chicago Quadrill Co. 201
Cincinnati Milling Machine Co.,
Heald Machine Co., Subsidiary ..... Inside Front Cover
Clearing Machine Corp., Division
U. S. Industries, Inc. 197
*Cleveland Instrument Co., Inc. 224
Cleveland Twist Drill Co. 213
Cogsdill Twist Drill Co. 4
*Crafts, Arthur A., Co., Inc. 156

D

*Denison Engineering Division,
American Brake Shoe Co. 28
*Devcon Corp. 152
*DeVlieg Machine Co.,
Microbore Division 21
Dickerman Mfg. Co., H. E. 126
*DoALL Co. 171, 180, 182, 184, 186
*Dow Chemical Co., The 24-25
Dumore Co., The 164
Dykem Co., The 166

E

Eastern Machine Screw Corp. 148
*Eastman Kodak Co. 133
*Eclipse Counterbore Co. 145
Electrons, Inc. 140
*Engelberg, Inc. 162
Ernest, Holdeman & Collett, Inc.,
Speedgrip Chuck Division 119
Ettco Tool & Machine Co., Inc. 152
Ex-Cell-O Corp. ..... 15, Inside Back Cover

F

Farquhar Division, A. B.,
The Oliver Corp. 129
*Fellows Gear Shaper Co. 185

G

Gaertner Scientific Corp. 120
Gardner Machine Co. 7
Gatco Rotary Bushing Co. 206
*General American Transportation Corp.,
Parker-Kalon Division 154
Gisholt Machine Co. 17-18-19-20
Greenlee Bros. & Co. 134
Grotnes Machine Works 224
*Gulf Oil Co. 178-179

H

Haloid Xerox, Inc. 166
*Handy & Harman 204
Hannifin Co., Division
Parker-Hannifin Corp. 29, 118
Hanson-Whitney Division,
Whitney Chain Co. 157
Hardinge Brothers, Inc. 5
Heald Machine Co., Subsidiary,
Cincinnati Milling Machine Co. ..... Inside Front Cover
Heuser Mfg. Co. 220
Hoggson & Pettis Mfg. Co. 180
*Huron Machine Products 184

J

*Jarvis Corp., The 159
*Jergens Tool Specialty Co. 224
*Jones & Lamson Machine Co. 14, 198

K

Kearney & Trecker Corp. 217
*Kennametal, Inc. 214
*King Tester Corp. 148

L

*Lapeer Mfg. Co. 122
*Latrobe Steel Co. 13
*Lee, K. O., Co. 182
Lempco Industrial, Inc. 141

Lincoln Electric Co. 6
Lindberg Engineering Co. 169
*Logan Engineering Co. 225
*Logansport Machine Co. 163

M

*Madison Industries, Inc. 173
Manhattan Rubber Division, Raybestos-Manhattan, Inc. 194
Marvel Tool & Machine Co. 220
*Metal Carbides Corp. 138
Meyers, W. F., Co. 184
*Milford Rivet & Machine Co. 127
*Modernair Corp. 182
*Mohawk Tools, Inc. 11

N

*National Acme Co., The 36
*National Broach & Machine Co. 31
National Machinery Co. 176
National Tool Co. 181
North American Aviation, Inc. 184
*Northwestern Tools, Inc. 192

O

Oliver Corp., The A. B. Farquhar Division 129
*Ortman-Miller Machine Co. 199
*Osborn Mfg. Co. 142

P

Parker Hannifin Corp., Hannifin Co., Division 29, 118
Parker-Kalon Corp., Division General American Transportation Co. 154
Parker-Majestic, Inc. 195
*Pines Engineering Co., Inc. 172
Pipe Machinery Co. 23
Pope Machinery Corp. 9
Precision Processing Co. 166
*Producto Machine Co., The 22

R

Raybestos-Manhattan, Inc., Manhattan Rubber Division 194
Reed Rolled Thread Die Co. 149
Rivett Lathe & Grinder, Inc. 174
Rockford Clutch Division, Borg-Warner Corp. 132
Roll & File Systems, Inc. 201

S

*Service Machine Co. 206
Severance Tool Industries, Inc. 206
*Simonds Abrasive Co. 165
*Simonds Saw & Steel Co. 33
*Simpson Optical Mfg. Co. 123
Sinclair Refining Co. 209
Speedgrip Chuck Division, Ernest, Holdeman & Collett, Inc. 119
*Standard Pressed Steel Co. 188
*Stone Machinery Co. 186
Sturtevant Co., P. A. 216
*Sun Oil Co. 2
*Sunnen Products Co. 144
Super Tool Co., Division Van Norman Industries, Inc. 166
Sykes Machine & Gear Corp. 180

T

Textron, Inc., Waterbury Farrel & Foundry Machine Co., Division .. 32
Thompson Grinder Co. 12
*Thor Power Tool Co. 168
Threadwell Tap & Die Co. 206, 216
Titan Tool Co. 201
*Torrington Co., The 175
Torrington Mfg. Co. 190-191

U

*Uddeholm Company of America, Inc. 223
U. S. Drill Head Co. 170
U. S. Hoffman Machinery Co. 210
U. S. Industries, Inc., Clearing Machine Corp. 197
Universal-Cyclops Steel Corp. 211

V

*Valvair Corp. 189
Van Norman Industries, Inc., Super Tool Co., Division 166
*Vascoloy-Ramet Mfg. Corp. 114
Verson AllSteel Press Co. ..... Back Cover
*Vlier Engineering, Inc. 222

W

Wallace Supplies Mfg. Co. 192
Waterbury Farrel Foundry & Machine Co., Division of Textron, Inc. 32
Whitney Chain Co., Hanson-Whitney Division 157
*Wilson Mechanical Instrument Division, American Chain & Cable Co. 160
Woodson Tool Co. 201

Y

Yoder Co., The 127

Z

Ziegler Tool Co., W. M. 192

REGIONAL ADVERTISING OFFICES:

NEW YORK
Austin G. Cragg
Francis Baldwin
John Clarke
400 Madison Avenue
New York 17, New York
Telephone: PLaza 9-4018

WEST HARTFORD
Donald N. McElwain
2636 Albany Avenue
West Hartford, Connecticut
Telephone: ADams 3-5997

CLEVELAND
Richard E. Cleary
15515 Detroit Avenue
Cleveland 7, Ohio
Telephone: LAkewood 1-7125

DETROIT
R. Alan Cobleigh
Clarence T. Etter
10700 Puritan Avenue
Detroit 38, Michigan
Telephone: UNiversity 4-7300

CHICAGO
Stanley F. Girard
612 N. Michigan Avenue
Chicago 11, Illinois
Telephone: Michigan 2-4465

LOS ANGELES
Robert E. Ahrensdorf
3275 Wilshire Boulevard
Los Angeles 5, California
Telephone: DUnkirk 2-7337

LOOKING AHEAD

By T. W. Black
Senior Associate Editor

Is America's industrial plant obsolete? Figures cited by Leo A. Hoegh, Director, Office of Civil and Defense Mobilization, indicate that more machine tools are overage now than at any time since the 1930's.

Speaking to the National Machine Tool Distributors Association, Mr. Hoegh pointed out that in 1945, 38 percent of our machine tools were at least 10 years old. By 1953, 56 percent were in this category, and 60 percent in 1958.

Several compelling reasons for modernization are cited by Mr. Hoegh. There has been a consistent three percent average annual rate of growth in the American economy for several years. Economists hold that this rate of growth should be increased to five percent. Such accelerated growth must come through increased productivity. Greater productivity also acts as a hedge against inflation and is, of course, essential to the national defense.

The importance of designing the tax structure so that a maximum of opportunity is preserved for the accumulation of equity capital--capital that can be invested in modernized facilities--is stressed by Mr. Hoegh.

✓ ✓ ✓

General Motors plant problems are being solved by what is described as "shop man's operations research." A seven-step methods engineering approach is used. The steps are: (1) Determine problem or objective; (2) study conditions; (3) plan possible solutions; (4) evaluate possible solutions; (5) recommend action; (6) follow up to assure action; and (7) check results. These steps are carried out by a planning team.

Actually, as pointed out by Harry D. Hall, director of the GM Process Development Section, the planning team idea evolved from a notion that automatic equipment was the usual answer to processing problems.

"Very early in our team study work," he says, "it became evident that major reduction in cost could often be made without high investment for special-purpose equipment, and most of the team studies to date have indicated the same basic result."

Most of the savings are in material cost reduction, achieved by economical use of material, design changes and substitute materials.

✓ ✓ ✓

Seventy-nine percent of the scientists and engineers surveyed in a University of Michigan poll of 10 companies do not favor collective bargaining to improve their salary and social status. The poll showed that there is a relationship between how an individual feels about his salary and how he views collective bargaining.

XLO EX-CELL-O FOR PRECISION

C

A

D

F

E

A. Standard DB 24 Spindle
B. DB 50 Motorized Spindle
C. DB 25 Square Body Spindle
D. DB 50 Motorized Quill-Type Spindle
E. DB 22 Square Body Spindle
F. Standard DB 22 Spindle

57-90

Greater Accuracy—with Ex-Cell-O Precision Boring Spindles

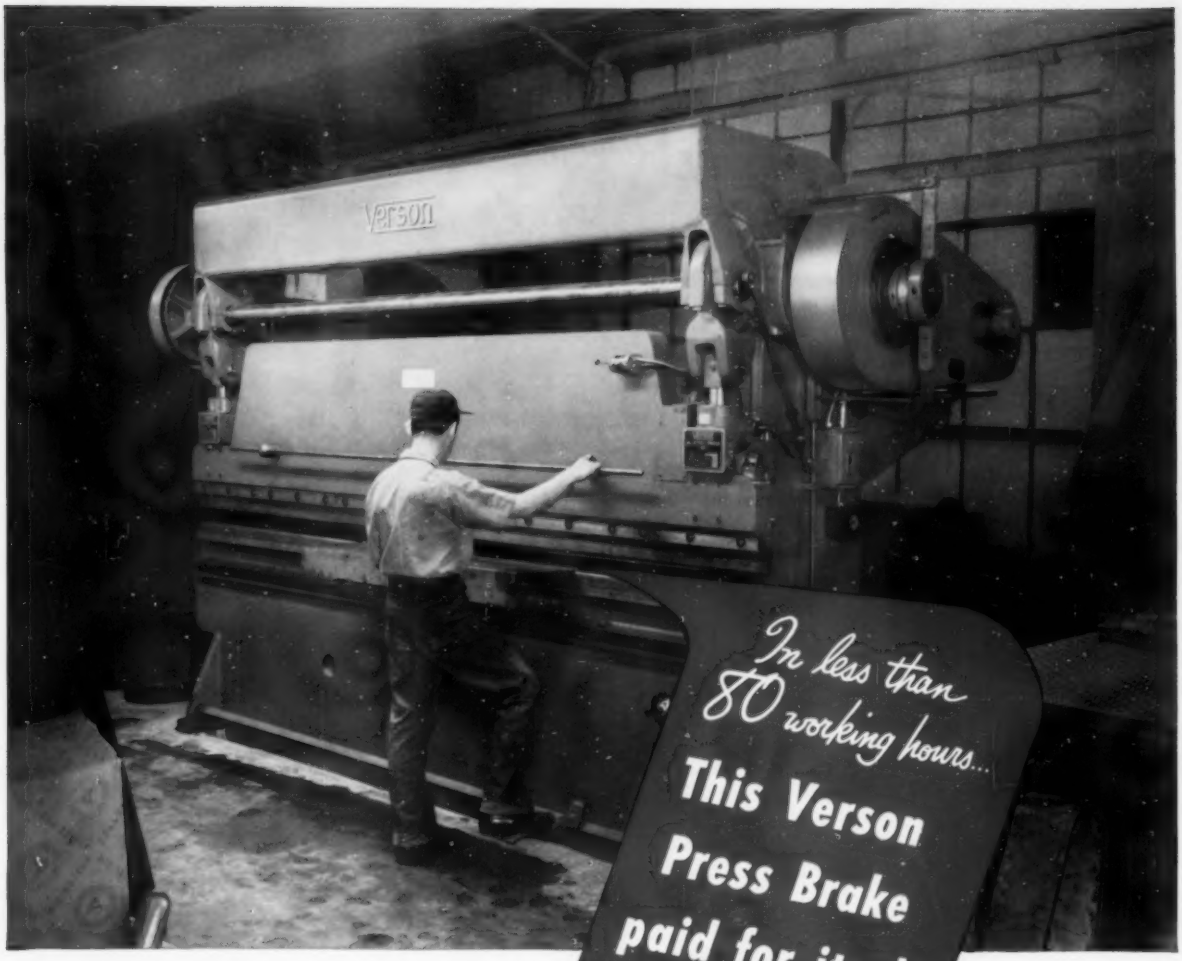
No one need tell you of the proven superiority of Ex-Cell-O precision boring spindles where close tolerances and fine finishes are required. But, did you know that these same Ex-Cell-O boring spindles have been used as replacement units for years?

Produced in belt-driven, standard motorized, or high frequency motorized styles, these Ex-Cell-O precision spindles are equipped with XLO Precision bearings for maximum spindle rigidity, long life and smooth operation. Permanent bearing lubrication reduces maintenance costs, prolongs bearing life.

For complete information, why not get in touch with your local Ex-Cell-O representative or, if you prefer, send direct for bulletin 25477.

EX-CELL-O CORPORATION *Machinery Division*
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



Add Chicago Dryer Company, Chicago, Illinois, to the ever-growing list of satisfied Verson Press Brake owners. In the manufacture of "America's most complete line of commercial flatwork ironers", Chicago Dryer Company uses this Verson No. 2010 Intermediate Series Press Brake to form flatwork ironer end frames from 5′ lengths of 11 ga. mild steel. Two bends are made, utilizing the Verson Press Brake handled by two operators. In the past, this job required six men working with a hand brake.

Two trays are furnished with each of fifteen flatwork ironer models manufactured. Formed from 12′ lengths of 16 ga. mild steel, the trays were formerly fabricated by an outside source. Carrying an inventory ranging from 5 to 25 trays for each of fifteen ironer models was necessary. Using the Verson Press Brake, trays are now formed as needed, eliminating inventory and reducing the cost per piece.

Although this Verson Brake has been operated only 80 working hours since installation, Chicago Dryer Company reports the machine has already paid for itself in labor savings, convenience and increased production.

A Verson Press Brake may be the answer to your metal forming problems. It costs nothing to investigate. Call or write, today.

A Verson Press for every job from 60 tons up.

212-C

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9336 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • 8300 S. CENTRAL EXPRESSWAY, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES